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May, 1887

A

COMPREHENSIVE HISTORY

OF THE

IRON TRADE.

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COMPREHENSIVE HISTORY

OF THE

IRON TRADE,

THROUGHOUT THE WORLD,

FROM THE EARLIEST RECORDS TO THE PRESENT PERIOD.

WITH AN APPENDIX,

CONTAINING

OFFICIAL TABLES, AND OTHER PUBLIC DOCUMENTS.

BY

HARRY SCRIVENOR,

BLAENAVON.

"Iron accommodates itself to all our wants, our desires, and even our caprices; it is equally serviceable to the arts, the sciences, to agriculture, and war; the same ore furnishes the sword, the ploughshare, the spring of a watch or of a carriage, the chisel, the chain, the anchor, the compass, the cannon, and the bomb. It is a medicine of much virtue, and the only metal friendly to the human frame."—Dr. Ure.

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PREFACE.

Of the multitude of new works continuously issuing from the Press, there are some which seem to command attention either from the reputation of the author, the interest of the matter, or the pleasing elegance of the style, and occasionally from a happy combination of all. The thirst for something new is quite as apparent in our day, as it was when the love of novelty was imputed as a fault to the Athenians; but we would hope and believe that the generation of this age is far less censurable. A search after knowledge, widely differs from that vague curiosity which sought to spend itself in the pernicious custom of reporting idle rumours, but the labour of the intelligent is to acquire what may be useful to themselves, their country, and the world, and to disseminate such knowledge.

The division of our Earth into nations, separated by natural or artificial boundaries, is no longer viewed as a stirring motive for virulent animosity, rousing one people against another in the hope of obtaining by violence the possessions of the weakest, destroying or scattering, thereby, the useful, intelligent, and industrious. Our nation has for many years been favoured by circumstances, as a manufacturing country. Strangers remarking the energy, industry, and perseverance of the British people, view obliquely the causes of success, and are apt to overlook, or not to discriminate between a judicious disbursement of capital of vast amount through a series of years, and the sudden creation of manufactures in their own countries, in situations where, indeed, some ostensible advantages invite; but rarely where the all-important ones of coal, water and land carriage, with

other requisites, are found united, as in Britain.—Unquestionably the foreigner excels in some manufactures those of Britain; and the cause may be explained satisfactorily, in such a case, when the article made abroad is from what nature there renders indigenous. Thus, the culture of wine, or silk, would in Britain probably be proved worse than a waste of time and labour; nor should we complain, when we become sensible that this order of things is adapted to promote advantage, leading to the legitimate object of mutual benefit among nations.

The unwearied pursuit of gain stimulates to ever increasing exertions, which bring in their train improvements in sciences, arts, and manufactures; every corner of the Earth is explored, and trade establishes a bond of union. A time of peace is most favourable to invention and its successful application, but in no art more strikingly so than in the manufacture of Iron, and its multiplied uses. In this spacious field we point to no limit. Ingenuity furnishes endless occasion for fresh demand, while at the same time equal industry is apparent in the corresponding exertions which create the supply.

Results which at no very remote period were deemed astounding, are become as nothing when compared with achievements now of weekly recurrence. Steam is the main spring,—the power which conducts our labours to this grand issue. Our ores of iron are brought forth, and in a period incredibly brief, are reduced and converted into such articles as are desired. Setting an example which other nations have closely imitated, the British iron masters are perpetually stimulated to improve the process of smelting, as well as to obtain thereby iron of improved quality. To them it therefore becomes highly useful to acquire correct knowledge of the progress of this art in other countries, particularly those which present themselves most prominently as competitors.

Very great advances have been made and are still going on in iron works abroad, and it would be worse than folly in us to repose in an unprofitable conviction of our superiority, to establish thereby confidence in error, to the prejudice of advantage;—nor should it be forgotten that the fair and honourable competition of nations pursuing mercantile affairs, widely varies from dissension, a maxim to be held perpetually in remembrance.

Evanescent and abortive endeavours are made in some countries, to create a system of manufacturing iron, but the failure of such undertakings not uncommonly displays a reverse fraught with greater loss of capital, and deeper distress to the district than could be anticipated even by prudence.

For success in operations of iron-making and dealing, immense capital seems necessary. The labour required is in proportion to the result, and the magnitude of some orders opposes an insurmountable difficulty to small capitals, while ample resources are able to surmount such difficulties and offer any extent of supply. Such hitherto has been the position of Britain, which still remains uppermost in this branch of trade, and in the pages of this work it has been attempted to demonstrate from enumeration of facts supported by arrangement, a clear summary of the comparative produce of nations most remarkable for their advance in this highly useful and extending branch of manufactures. Greatest stress is laid upon the make in our country, and of that of the United States of America, as offering the next most extended field of the present day. The continental nations have also been placed in review, and here exhibit what has been deemed sufficient to mark their position in the trade and manufacture of iron.

The authorities to which this work is indebted, are, as may be readily believed, very numerous; a complete list of them it would be now almost impossible to arrange, as many

years had elapsed before the idea of compiling and writing for publication originated. It is not without regret that it has been subsequently found impossible to append in all cases the names of the authors from whom passages, or the substance of a description may be borrowed; it must be obvious, that in writing upon a subject the mind must be previously imbued or stored with ideas which have been gleaned imperceptibly from reading, and hence thoughts run on in the same channel; the very same expressions are adopted in committing them to paper, without any recollection of their origin. With a view therefore to point out and mark to what sources and authorities this work on the History of the Iron Trade is indebted and refers, it has been deemed quite indispensable to annex such a list as it is hoped will be sufficiently available.

LIST OF SOME AUTHORITIES QUOTED AND USED IN THIS WORK.

The Bible.
Herodotus.
Cesar.
Strabo.
Livy.
Tacitus.
Suetonius.
Pliny.
Diodorus Siculus.

Hook's Roman History.
Rollins' Ancient History.
Raynal's History of the Indies.
Millot's Ancient History.
Gibbon's Decline and Fall of Rome.
Pinkerton's Geography.
Robertson's Histories.
Mungo Park's Africa.
Caillie's Africa.
Celtic Researches.
Pallas' Travels in Russia.
Granville's Travels in Russia.
Laborde's Spain.
Ferber's Italy.
Camden's Britannia.
Encyclopædia Britannica and Supplement.
Rees' Cyclopædia.
Edinburgh Cyclopædia.
Macpherson's Annals of Commerce.
Tooke's View of the Russian Empire.
Travels in Sweden—Thomson.
Travels in Russia—Coxe.
Newenham's Ireland.
Lysons' Magna Britannia.
Henry's Great Britain.
Hume's History of England.
Wallis' Northumberland.
Shawe's Staffordshire.
Plot's Staffordshire.
Charles Leigh's Lancashire and Cheshire.
Williams' Monmouthshire.
Coxe's Monmouthshire.
Malkin's Antiquities of South Wales.
Warner's History of Bath.
Musgrave's Belgium Britannicum.
Sinclair's Statistics of Scotland.
Statutes at large.
G. Boate's History of Ireland.
Anderson's History of Commerce.
Aiken's Chemical Dictionary.
Oddy's European Commerce.
Fraser's Travels, Himalaya.
Sir W. Lloyd's Travels, Himalaya.
Seybert's Statistical Annals.
Dr. Bowring's Report on the Commercial Relations with France.
Journal des Mines.
Philosophical Transactions.
Annual Register.
Quarterly Review.
Edinburgh Review.
Foreign Quarterly Review.
Parliamentary Records.
Hansard's Parliamentary Debates.
West's Antiquities of Furness.

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THE HISTORY

OF

THE IRON TRADE.

INTRODUCTION.

In offering to the public a treatise, tracing the history of the rise and progress of the iron trade to its present state, the author ventures to believe that the importance of the subject, and the vast interest which this branch of our industry holds in general estimation, may lead to the conviction that such a work cannot be wholly unacceptable to any reader, but from its tenour, is calculated to be interesting in a mercantile and even national point of view. The design of the work is not to describe the various uses or manufactures of iron into instruments, or machinery, (a field already occupied by Dr. Lardner,) but to report from researches into ancient and later writers, what they have noticed of importance relative to the history of iron, leaving opportunity and occasion for the author's remarks throughout the treatise,—an arrangement, which it is conceived will not be objectionable to any who may be disposed to allow this volume a place amongst books of reference.

The pursuit of information necessary for the establishment of matter of fact, and a desire to exclude irrelevant theory, have added to the labours of the author; and he has endea-

voured so to condense, as to offer, in one volume, the fruits of many years' investigation, hoping thus to have avoided prolixity without any sacrifice of the necessary explanatory details. The absence of any publication similar to this, and the scanty information to be gleaned from the scientific journals of this country, claim for this work at the hands of the public, liberal consideration; and if criticism be disposed to severity, it should not be forgotten that a work of this character precludes the introduction of matter other than that which a close adherence to the subject renders admissible.

It is presumed that the tables accompanying the several chapters, will be valued not only in many instances from their being rare, but because presenting much useful information to the notice of the intelligent and observant reader.

In speaking of this metal, Dr. Ure, in his "Dictionary of Arts, Manufactures," &c., thus expresses himself:—"Every person knows the manifold uses of this truly precious metal; it is capable of being cast in moulds of any form —of being drawn out into wires of any desired strength or fineness—of being extended into plates or sheets—of being bent in every direction—of being sharpened, hardened, and softened, at pleasure. Iron accommodates itself to all our wants, our desires, and even our caprices; it is equally serviceable to the arts, the sciences, to agriculture, and war; the same ore furnishes the sword, the ploughshare, the spring of a watch or of a carriage, the chisel, the chain, the anchor, the compass, the cannon, and the bomb. It is a medicine of much virtue, and the only metal friendly to the human frame. The ores of iron are scattered over the crust of the globe with a beneficent profusion, proportioned to the utility of the metal; they are found under every latitude and every zone, in every mineral formation, and are disseminated in every soil."

The increased value of manufactured iron, compared with the raw material, cannot, perhaps, be better illustrated than by taking as an example the price of Berlin cast-iron ornaments, which, in some cases, is equal to upwards of 55,000*l.* per ton, while the cost of the raw ore, from whence the article

is manufactured, cannot be taken at more than thirty shillings per ton.*

In one of the principal manufactories of this description in Berlin, that of Devaranne, such is the fineness and delicacy of those separate arabesques, rosettes, medallions, &c., of which the larger ornaments are composed, that nearly ten thousand go to the pound, the price increasing in proportion to the fineness, as will be seen by the following table, which gives the selling prices at this establishment:—

	No. to the cwt.	Price of each article.			Price p. cwt. of the same.		
1. Buckles, $3\frac{1}{2}$ inches long, and $2\frac{1}{2}$ inches broad	2640	£0	2	6	£330	0	0
2. Neck chains, 18 inches long, and 1 inch broad, and composed of 40 separate pieces	2310	0	6	0	693	0	0
3. Bracelets, 7 inches long, and 2 inches broad, and composed of 72 pieces .... pair	2090	0	8	6	888	5	0
4. Diadems, $7\frac{1}{2}$ inches high, and $5\frac{1}{4}$ inches broad	1100	0	16	6	907	10	0
5. Sevigné needles, $2\frac{1}{2}$ inches long, and $1\frac{1}{2}$ inch broad, and composed of 11 parts	9020	0	4	6	202	10	0
6. Sevigné earrings, 3 inches long, and $\frac{7}{8}$ inches broad, and composed of 24 pieces .. pair	10,450	0	5	3	2743	2	6
7. Shirt buttons	88,440	0	8	0	2948	0	0

The articles written on the subject, which have appeared in "Rees's Cyclopædia" and in the "Supplement to the Encyclopædia Britannica," are confined exclusively to the history of our own manufacture, and were written (more particularly the former) when the trade was comparatively in its infancy. The interest excited, at the present time, by any allusion to the state or prospects of the trade, is fully proved, by the ready transfer of papers touching on the subject from the columns of one journal to another: these notices, however, barely extending beyond some statistical details over a confined period. Attention has lately been drawn to the progress perceptible in this manufacture in France, where the facilities are afforded for acquiring correct information as to the state of this branch of metallurgy; but still, without considerable research, little or no information can be obtained of the state of foreign manufacture in general. Without this information

* From Dr. Friedenberg's German edition of Mr. Babbage's "Economy of Machinery and Manufactures."

it is impossible to arrive at a satisfactory conclusion as to the exact position in which we stand with regard to other countries—a species of information, which in itself would be peculiarly valuable at the present time, when all seem eager to increase to the utmost, and to take advantage of, the means placed at their disposal, by the inexhaustible mineral resources of this kingdom. The main object of this series of papers, next to the history of our own trade, is, then, to place in a clear and correct point of view the rise and progress of the trade in all countries where iron may be considered to be a staple manufacture.

The importance and use of official documents will be readily admitted, and these the author has been fortunate enough to procure, from a very early period up to the present time, by means of assistance afforded him by parties connected with this and other countries, and which has thus enabled him to bring together a mass of information on the subject as valuable as it is authentic. The official documents relating to our own trade extend over a period of 130 years, commencing in the year 1710, when returns connected with it were first moved for in Parliament. Most of these returns were procured shortly before the destruction of the Houses of Parliament by fire, when, in all probability, those of an earlier date were destroyed. The official returns of other countries extend over a considerable period, and the author's best thanks are due to those who afforded him the means of obtaining so much information necessary to his object. He may here observe, that he has been greatly strengthened in his idea of publishing the result of his labours (which were first commenced for his own information, and on which he has bestowed a considerable portion of his leisure hours for some years), by the readiness with which members of Parliament and others came forward to assist him when informed of the nature of his inquiries. The late Speaker (now Lord Canterbury), on the introduction of a highly respected member of the House of Commons, gave the author free access to the library of the House, without the usual condition of being accompanied by the member at whose request the privilege was granted—a

regulation from which there had never been a deviation except in one previous instance. Through the kindness of the same member (Dr. Phillimore), the Speaker then gave an order on the printer to the House for the author to be furnished with the whole of the printed returns. In the statistics submitted all may feel an interest, not only in tracing the progress, and marking the improvements, but also in the useful and valuable deductions which may be drawn by the political economist and the man of business, in regard to the effect likely to be produced hereafter on the iron trade.

It is proposed, in the following work, to trace the origin and use of the metal—the advance and improvements which have taken place—to consider the important question, how far the trade of this country is likely to be interfered with by foreign manufacture?—and, at the same time, clearly to demonstrate the immense advantages we possess over other countries, and the improbability of their interference, to any extent, sufficient to affect our permanent prosperity. The first chapter will show the early discovery of iron—the knowledge which the ancients had of this metal—and the purposes to which it was applied. The subsequent chapters will then trace the working of it in this country, from the time of the Romans to the almost total destruction of the manufacture, from the want of fuel, after the attempts to make coal available as a substitute for charcoal had failed, and note the progress and loss of the trade in Ireland, and the rise and history of the manufacture in the British colonies in America, up to the period of the war, when they established their independence. Its history in Great Britain, is then continued from the invention of the blast-engine, the establishment of coal as fuel, and the introduction of certain valuable improvements in the manufacture of iron down to the year 1830, and previously to the further consideration of the home manufacture, the foreign trade is traced in its progress in each country separately, commencing with Spain.

Although the iron of Spain is of excellent quality, and probably more ductile than any other, it has never been a manufacture of any extent except at an early period, and then

only in comparison with the confined rate of production of other countries. Not so Sweden and Russia: these countries are remarkable not only for their extensive make, but also for the superior quality of their iron; for many years we derived our principal supply from Sweden, till the rivalry of Russia interfered, and during the period in which, from want of fuel, our trade was at a stand still, we annually received many thousand tons from both these countries. Coal, the blast-engine, and our local advantages, have, however, so completely superseded the use of foreign iron, that little or none is now imported, except for conversion into steel, and in this description of iron these nations are still without a rival—the finest steel iron used in this country being manufactured in Sweden, and some of the most useful, for particular purposes, in Russia.

The histories of France and America open a wider field of inquiry, and are, in every respect, more vitally important to the iron manufacturing interests of this country. In the case of Sweden and Russia, a certain extent of make has been arrived at, beyond which it is not likely materially to advance. They supply almost exclusively their own wants, but the cost at which their iron is manufactured precludes the possibility of their entering into any extensive competition with our own in foreign markets. In the American alone can they venture to meet us, and there the competition arises from the heavy and unequal duties imposed by the States on our iron, in order to prevent its interfering with their own manufacture. Both France and America uphold the monopoly of the raw material to the injury of all consumers, manufacturing as well as agricultural, and their shipping interests also severely feel the impolicy of this course of proceeding. An American writer thus comments upon the circumstance:—"We have wantonly sacrificed 'the comprehensive and permanent interests of the State to the particular and separate views of the counties or districts in which we reside.'"*

The baneful effect of individual interest operates to protect

* Cambreleng's "Report to the Committee on the Commerce and Navigation of the United States."

the monopoly in France. Messrs. Villiers and Bowring, in their "Report on the Commercial Relations between France and Great Britain," make the following observation:—"In France a very large proportion of those who are interested in the continuance of the existing commercial system, are elevated public functionaries, or are placed in immediate contact with them."

The time is, however, near at hand, when, in all probability, this exclusive system will be abolished, and our iron admitted in both these countries at a moderate duty.

The interest and importance of this inquiry have induced the author to give at some length the history of the manufacture in both these countries; and he takes this opportunity of expressing his sincere thanks to Petty Vaughan, Esq., of London, to whose kindness, in allowing him the use of his library, he is indebted for the principal material for this work, as connected with the United States.

Belgium, the German States, and some notice of Asia will close the inquiry into foreign manufacture.

The concluding chapter will continue the history of the home manufacture from the year 1830 to the present time, with observations on the present state and prospects of the trade.

CHAPTER I.

EARLY PERIOD.

It may be necessary to premise this chapter by stating that, with the minute notice, and a detail of the various iron ores and their location, the author scarcely interferes, being well aware that that department more justly belongs to the practical geologist, from whose labours increasing information is constantly elicited, and rational conclusions are leading our views to the exalted origin of all knowledge. In the pursuit of scientific research, the utmost labour of the most enlightened, and the expanded ideas of the most learned philosopher, can reach but an atom of immeasurable omniscience. What then is the boast of human knowledge, the pride of man's learning? A few steps in the field, a few flowers gathered, from the ever-increasing myriads which nature presents every where to notice. How many vain attempts of our primitive fathers were essayed, ere iron, the most plentiful and useful of all metals, was brought forth from the stubborn ores in which it was hidden! How zealous the daily and midnight endeavours of the alchemist to convert iron or stone into precious metals, or by a synthetical process to form gold! A recurrence to the curious records of such abortive labours may occasion a smile, grounded upon our advanced knowledge and experience. Which, of all the civilised nations of this refined age, is yet able to solve the problem of the formation or growth of metals? and to what human source may we, even in these times, turn for such information? Was there ever, since the creation of this globe, a time ere metals existed, when man might in vain have explored the inmost recesses of the everlasting hills for the discovery? The answer to this is not less easy, perhaps, than

that to the former question; both present a wide field for the maturest reflection, and give rise to a full consciousness of our feebleness; but more especially should it confirm us in humility. Science cannot yet unravel this mysterious growth, or natural origin of iron, or the other metals. In our earliest and most authentic history (the Bible), we do not find a solution of the difficulty, but only know God created all things, and that by his almighty power they are continued.

It is a doubtful point, whether the dominion of man over the animal creation, or his acquiring the useful metals, has contributed most to extend his power. The era of this important discovery is unknown, and very remote. It is only by tradition, or by digging up some rude instruments of our forefathers, that we learn that mankind were originally unacquainted with the use of metals, and endeavoured to supply the want of them by employing flints, shells, bones, and other hard substances, for the same purposes which metals serve among polished nations. Nature completes the formation of some metals. Gold, silver, and copper are found in their perfect state in the clefts of rocks, in the sides of mountains, or the channels of rivers. These were, accordingly, the metals first known and first applied to use; but iron, the most serviceable of all, and to which man is most indebted, is never discovered in its perfect form; its gross and stubborn ore must feel twice the force of fire, and go through two laborious processes, before it becomes fit for use. Man was long acquainted with the other metals before he acquired the art of fabricating iron, or attaining such ingenuity as to perfect an invention to which he is indebted for those instruments wherewith he subdues the earth and commands all its inhabitants. In our present state, when we depend so greatly upon the use of iron and steel, it is difficult to conceive how man could exist in a state of society without their aid. From the Scriptures we learn that, but a short time after the Creation, Tubal Cain, a descendant of Cain, the son of Adam, was "an instructor of every artificer in brass and iron."* And we find in the sacred volume, as the

* Gen. iv. 22.

following quotations abundantly testify, singular evidence of the acquaintance which the Jews and other Asiatic nations had with the uses of metals. Mention is made of a land whose stones are iron; allusion is made to the furnace of iron. Vast numbers of chariots of iron are stated to have been employed by the Canaanites in their wars; and it is more than probable that those of Pharaoh, in his pursuit of the Israelites, were partly of that material (B.C. 1500). It is also said, that Og's bedstead was iron; and if we now descend the stream of time to David's era (B. C. 1044), plain mention is made of Goliah's iron spear-head, of saws, axes, and harrows of *iron*, of hammer and axe, of a rod of *iron*, bars of iron, of fetters of iron; in Job of barbed iron and fish spears; and by Jeremiah of northern iron and steel, of yokes of iron, a pillar of iron, a pen of iron. Ezekiel (B. C. 590) speaks of a pan of iron, of trading with iron, of bright iron, &c. in thy market. It would be easy perhaps to largely increase the list of such notices in sacred writ; but we conceive this selection is amply adequate to the establishment of the fact, that the skill of those nations, in the working and forging articles of well-prepared iron, was continually exercised, and therefore that the art must have greatly advanced, and have become familiar to the people adjacent. The ancient mythologists attributed the invention to Vulcan, the god of subterranean fire and metals, whom Sir Isaac Newton supposes to have been the same with Cinyras, king of Lemnos, an inventor of the art, who found out copper in Cyprus, the smith's hammer, anvil, and tongs, and employed workmen in making armour and other things in brass and iron. He was the only king celebrated in history for working in metals.

Herodotus says that a class of men, called *Curetes* (B.C. 1500), who were celebrated for their skill in the arts and sciences, were brought into Greece from Phœnicia, by Cadmus, son of Agenor, king of that country—some settled in Phrygia, and were called *Corybantes*—others in Crete, where they were called *Idaci Dactyli*—some in Rhodes, called *Telchines*—some in Samothrace, and were there called *Cabiri*—others in

Eubœa, where, before the invention of iron, they worked in copper, in a city called Chalcis—some in Lemnos, where they assisted Vulcan—and some in Imbrus and other places. By the assistance of these artificers Cadmus discovered gold in the mountain Pangæus, in Thrace, and copper at Thebes—whence copper ore is still termed Cadmia.

In the countries where they settled they first wrought in copper till iron was discovered, and then in iron; they made arms, and edged-tools for hewing and carving wood, which gave Minos, king of Crete (B.C. 1406), an opportunity of building a fleet and gaining dominion of the sea, and of establishing the trades of smiths and carpenters in Greece. A short time after, Dædalus and his nephew, Talus, invented the wedge, the saw, and the axe, the wimble, the perpendicular, and compasses, the turning lathe, glue, and potters' wheel, and many other mechanical instruments, and the sails of ships; and Epalamus invented the anchor—these were in the reign of Solomon. The invention of the art of fabricating iron by the Idaci Dactyli is, by Sir Isaac Newton, fixed at about 1035 years before Christ, which metal it is said, they discovered from the fusion of minerals at the accidental burning of the woods on the mountain Ida, in Crete; others make it 400 years earlier. It seems, however, that the historians of antiquity have, in most cases, either attributed the discovery of metals to their gods, or they have deified those to whom mankind are so wholly indebted, for having, by that means, been the founders of the present state of society.*

The early fame of Sidon, and afterwards its rival Tyre, for trading and riches, mark their civilization; and these Phenicians, whose numerous vessels proclaim nautical knowledge, being a people from Asia, where iron was first discovered and

* Herodotus, book i. chap. 25. Beloe's Translation—Clio. (Glaucus, an inhabitant of Chios, invented the art of inlaying with iron.—Pausanias, book x.) He curiously inlayed a saucer of iron; it is of surprising workmanship, and as worthy of observation as any of the things preserved at Delphi. The name of the maker was Glaucus, an inhabitant of Chios, and the inventor of this art of inlaying iron—presented as an offering at Delphi, by Alyattes, the father of Crœsus, about 560 years before the Christian era.

used, lead to the conclusion that this busy nation taught their arts to other people.*

In the Trojan war, at the period when the pyramids of Egypt were built, before Christ 1186, the Tyrians seem to have navigated the Mediterranean to the pillars of Hercules, and shortly after the seas beyond, and their discovery of the British Isles was, it is supposed, about coeval with Nebuchadnezzar (Babylonian Captivity, B.C. 600).

The earliest writers on the manufacture of iron are Diodorus Siculus and Pliny the Elder; the former mentions the island of Æthalia (Elba) as abounding with ironstone, "which the natives dig and cut out of the ground to melt, in order for the making of iron; much of which metal is in this sort of stone. The workmen employed first cut the stone in pieces, and then melt them in furnaces, built and prepared for the purpose. In these furnaces the stones, by the violent heat of the fire, are melted into several pieces, in form like great sponges, which the merchants buy by truck, and exchange of other wares, and export them to Dicœarchea and other mart towns.

"Some of these merchants that buy of these wares cause them to be wrought by the coppersmiths, who beat and fashion them into all sorts of tools, instruments, and other shapes and fancies; some they neatly beat into the shape of birds, others into spades, hooks, and other sorts of utensils—all which are transported and carried about into several parts of the world by the merchants."

Pliny, in his Natural History, enters at much greater length into the account of the manufacture and general use of this metal than Diodorus, and the exceeding interest of his history, written in the early part of the first century, renders it peculiarly valuable to this work. After treating on other metals, he observes—"It remaineth now, in the next place, to discourse of the mines of iron, a metal which we may well say is both the best and the worst implement used now in the world; for,

* Solomon, when about to build the Temple at Jerusalem, solicited Hiram, king of Tyre, to send to him a man cunning to work in gold, and silver, and brass, and iron, and Hiram did accordingly. 2 Chron. ch. ii.

with the help of iron, we break up and tear the ground—we plant and plot our groves—we set our portyards, and range our fruitful trees in rows—we prune our vines, and, by cutting off the superfluous branches and dead wood, we make them every year to look fresh and young again. By means of iron and steel we build houses, hew quarries, and cut in stone—yea, and in one word, we use it to all other necessary uses of this life.

"Contrariwise, the same iron serveth for wars, murders, and robberies; not only to offend and strike therewith in hand, but also to reach and kill afar off, with divers sorts of darts and shot; one whiles discharged and sent out of engines, another while launched and flung by the force of the arm—yea, and sometimes let fly with wings. This I take to be the wickedest invention that ever was devised by the head of man; for, to the end that death may speed away the faster to a man, and surprise him more suddenly, we make it to fly as a bird in the air, and to the arrow, headed at one end with deadly iron, we set feathers at the other, whereby it is evident that the mischief proceeding from iron is not to be imputed to the nature of it, but to the unhappy wit of man.

"For good proof we had already by many experiments otherwise, that iron might be employed and occupied without any hurt or harm at all to mankind. And, verily, in those capitulations of peace, which, after the expulsion of the kings, Porsena, king of the Tuscanes, tendered unto the people of Rome, I find this express article and imposition—that they should not use iron, but only about tillage of the ground. And, as our chronicles of greatest antiquity have left recorded, it was not thought safe to permit writing and engraving letters with a style of iron. Certes, in the third consulship of Pompey the Great, by occasion of a tumult and commotion raised within the city of Rome, for the murder committed upon the person of P. Clodius, there was an edict came forth (which is now extant upon record), after this form,—'*Ne ullum telum in urbe esset.*' 'That no man throughout all Rome shall be seen to wear a weapon,' Ne-

vertheless, men did not forbear and give over to do some honour unto iron; also, in some other occasions of this life, tending to the entertaining of civility and humanity, for Aristonides, the cunning artificer, minding to represent in an image the furious rage of Athamas, beginning now to cool and be allayed, together with his repentance for the cruel murdering of his own son, Learchus, whom he flung headlong against the hard stones, and thereby dashed out his brains, made a temperature of brass and iron together, to the end, that the rusty iron, appearing through the bright lustre of the brass, might lively express a blushing red in the countenance, beseeming a man confused and dismayed for so unnatural a fact. This statue is, at this day to be seen at Thebes; within the same city there is another image of Hercules, all of hard iron or steel, which Alcon, the famous workman, made of purpose to signify the undaunted heart of that deified Hercules, who underwent and endured all labours and perils whatsoever. Here, also, in Rome, we may see certain drinking cups of steel, dedicated in the temple of Mars the Revenger.

"But to come unto the nature of iron, herein appeareth still the same goodness of Nature, that this metal, working such mischief as it doth, shall be revenged of itself, and receive condign punishment by its own rust. See also the wonderful providence of Nature, who maketh nothing in the world more subject to death and corruption than that which is most hurtful and deadly to mankind.

"As touching mines of iron ore, they are to be found almost in every country, for there is not so much as the island of Ilua (Elba), here within Italy, but it breedeth iron. And lightly wheresoever any such be, they are easily discovered, for the very leer of the earth, resembling the colour of ore, betrayeth where they lie; and when it is found out they burn, try, and fine it, as other veins of metal. Only in Cappadocia there is some question and doubt made, whether, in the making of iron, they be more beholden to the earth that yieldeth the ore, or to the water for the preparing and ordering of it? For this is certain, that unless the vein of ore be well drenched

and soaked with the water of one river there, it will never yield iron out of the furnace.

"As for the kinds of iron, many there are and all distinct. The first difference ariseth from the diversity of the soil and climate where the mines be found; for in some places the ground and the position of the heavens do yield only a soft ore, and coming nearer to the substance of lead than iron; in another the metal is brittle and short, standing much upon a vein of brass, such as will not serve one whit for stroke and nail to bind cart-wheels withal, which tire, indeed, should be made of the other, which is gentle and pliable. Moreover, some kind of iron there is that serveth only, if it be wrought in short and small works, as, namely, for nails, studs, and tacks, employed about greaves and leg-harness: another, again, that is more apt to take rust and canker than the rest. Howbeit, all sorts of iron ore are termed in Latin *stricturæ*, a word appropriate to this metal and to no other—*à stringendâ acie*, 'of dazzling the eyes, or drawing a naked sword.'

"But the furnace itself, where the ore or ironstone is tried, maketh the greatest difference that is, for therein you shall have to arise, by much burning and fining, the purest parts thereof, which, in Latin, is called *nucleus ferri*—'the kernel or heart of the iron' (and it is that which we call steel), and the same also of divers sorts; for the best is it that hardeneth the edge of any weapon or tool: there is of it which serveth better for stithy or anvil heads, the faces of hammers, bits of mattocks, and iron crows; but the most variety of iron cometh by the means of the water, wherein the iron, red-hot, is oft soon dipped and quenched for to be hardened. And, verily, water only which in some place is better, in other worse, is that which hath ennobled many places for the excellent iron that cometh from them, as, namely, Bilbilis, in Spain, and Tarassio, Comus, also in Italy, for none of these places have any iron mines of their own, and yet there is no talk but of the iron and steel that cometh from thence. Howbeit, as many kinds of iron as there be, none shall match in goodness the steel that cometh from the Seres, for this commodity also, as hardware as it is, they send and sell with their soft silks

and fine furs. In a second degree of goodness may be placed the Parthian iron. And, setting aside these two countries, I know not where there be any bars or gads tempered of fine and pure steel, indeed, for all the rest have a mixture of iron more or less; and, generally in the west parts of the world wherein we live, all our steel is of a more soft and gentle temperature than that of the Levant.

"This goodness of steel, in some countries, ariseth from the nature of the mine, as in Austrich; in others from the handling and temperature thereof, like as by quenching, as I said before, and, namely, at Sulmo, where the water serveth especially for that purpose; and no marvel, for we see a great difference in whetting and sharpening the edge of any instrument between oil whetstones that barbers use and the common water grindstones, for, surely, the oil giveth a more fine and delicate edge. Furthermore, this is strange, that when the ore or vein is in the furnace it yieldeth iron liquid, and clear as water, and afterwards being reduced into bars and gads, when it is red-hot, it is spongious and brittle, apt to break or resolve into flakes. And, considering the difference that is between the nature of oil and water, (as I have said), this is to be observed, that the finer any edge tools be, the manner is to quench them in oil for to harden the edge, for fear lest the water should harden them overmuch, and make the edge more ready to break out into nicks, than to bind and turn again. But, wonderful it is above all, that man's blood should have such a virtue in it, as to be revenged of the iron blade that shed it; for, being once imbrued therein, it is given ever after eftsoons to rust and canker.

"Concerning the loadstone and the great concord and amity between iron and it, I mean to write more amply in the due place. Howbeit, for the present thus much I must needs say, that iron is the only metal which receiveth strength from that stone—yea, and keepeth the same a long time, insomuch, as by virtue thereof, if it be once well touched and rubbed withal, it is able to take hold of other pieces of iron; and thus otherwhiles we may see a number of rings hanging together in manner of a chain, notwithstanding they be not

linked and enclosed one within another. The ignorant people, seeing these rings thus rubbed with the loadstone, and cleaving one to another, call it quickiron. Certes, any wounds made by such a tool, are more eager and angry than by another. This stone is to be found in Biscay, scattered here and there in small pieces by way of bubbation (for that is the term they use); but it is not that true magnet or loadstone, indeed, which groweth in one continued rock; and I wot not whether these be so good for glass-makers, and serveth their turn so well in melting their glass as the other, for no man yet hath made any experiment thereof. But sure I am, that if one do rub the edge, back, or blade of a knife therewith, it doth impart an attractive virtue of iron thereunto, as well as the right magnet. And here I cannot choose but acquaint you with the singular invention of that great architect and master deviser, of Alexandria, in Egypt, Dinocrates,* who began to make the arched roof of the temple of Arsinoe all of magnet or this loadstone, to the end, that within that temple the statue of the said princess, made of iron, might seem to hang in the air by nothing—but prevented he was by death, before he could finish his work, like as King Ptolemy also, who ordained that temple to be built in the honour of the said Arsinoe, his sister.

"But to return again to our iron: of all mines that be, the vein of this metal is largest, and spreadeth itself into most lengths every way, as we may see in that part of Biscay that coasteth along the sea, and upon the ocean beneath, where there is a craggy mountain, very steep and high, which standeth all upon a mine or vein of iron. A wonderful thing, and in a manner incredible—howbeit, most true, according as I have showed already in my cosmography, as touching the circuit of the ocean.

"Iron made once hot in the fire, unless it be hardened with

* Dinocrates, an architect of Macedonia, who proposed to Alexander to cut Mount Athos in the form of a statue, holding a city in one hand, and in the other a basin, into which all the waters of the mountain should empty themselves. This project Alexander rejected as too chimerical, but he employed the talents of the artist in building and beautifying Alexandria.—*Lempriere.*

the hammer, dost soon waste and corrupt. So long as it looketh but red, it is not ready for the hammer, neither should it be beaten before it look white in the fire. Besmear it with vinegar and alum, it will look like copper or brass. If you be desirous to keep any iron-work from rust, give it a varnish with ceruse plaster and tar, incorporate all together, and this is that composition which is called, by the Greeks, antipathia. And some say that there is a kind of hallowing iron within the city, called Zeugma,* seated upon Euphrates, wherewith King Alexander the Great sometime bound and strengthened the bridge over the river there; the links whereof, as many as have been repaired and made new since, do gather rust, whereas the rest of the first making be all free therefrom."

It appears, from these accounts, that iron was well known in the early ages, and applied to various useful purposes.† The earliest method of working the furnaces where ores were smelted, seems to have been by exposing them to the wind—such was the practice of the Peruvians before the arrival of the Spaniards. From Alonso Barba we learn that their furnaces, called *guairas*,‡ were built on eminences, where the air was freest; that they were perforated on all sides with holes, through which the air was driven in when the wind blew, which was the only time when the work could be carried on,

* Zeugma, a town of Mesopotamia, on the western bank of the Euphrates, where was a well-known passage across the river. It was the western boundary of the Roman empire, and, in Pliny's age, a chain of iron was said to extend across it.—*Lempriere.*

† Pliny also mentions some hidden qualities of this metal, which must not be forgotten:—"As touching the use of iron and steel, in physic, it serveth otherwise than for to lance, cut, or dismember withal, for take a knife or dagger, and make an imaginary circle two or three times round, with the point thereof, upon a young child or an elder body, and then go round withal about the party as often, it is a singular preservation against all poisons, sorceries, or enchantments. Also to take any iron nail out of the coffin or sepulchre wherein man or woman lieth buried, and to stick the same fast to the lintel or side post of a door, leading either to the house or bed-chamber where any doth lie who is haunted with spirits in the night, he or she shall be delivered and secured from such fantastical illusions. Moreover, it is said, that if one be lightly pricked with point of sword or dagger, which hath been the death of a man, it is an excellent remedy against the pains of sides or breast, which come with sudden pricks or stitches."—*Dr. Holland's Translation.*

‡ To smelt the silver ore.

and that under each hole was made a projection of the stone-work, on which was laid burning coals to heat the air before it entered the furnace.

Mungo Park, in his travels in Africa, mentions that, during his stay at Kamalia, there was a smelting furnace at a short distance from the hut where he lodged, and that he assisted the owner in breaking the ironstone. The furnace was a circular tower of clay, about ten feet in height, and three in diameter, surrounded in two places with withes, to prevent the clay from cracking and falling to pieces by the violence of the heat. Round the lower part, on a level with the ground, but not so low as the bottom of the furnace, which was somewhat concave, were made seven openings, into each of which were placed three tubes of clay, and the openings again plastered up in such a manner that no air could enter the furnace but through the tubes; by the opening and shutting of which the fire was regulated. These tubes were formed by plastering a mixture of clay and grass round a smooth roller of wood, which, as soon as the clay began to harden was withdrawn, and the tube left to dry in the sun.*

The ironstone he describes as very heavy, and of a dull red colour, with greyish specks; it was broken into pieces, about the size of a hen's egg: a bundle of dry wood was first put into the furnace, and covered with a considerable quantity of charcoal, which was brought ready burnt from the woods; over this was laid a stratum of ironstone and then another of charcoal, and so on until the furnace was quite full. The fire was applied through one of the tubes, and blown for some time with bellows made of goats' skins. The operation went on very slowly at first, and it was some hours before the flame appeared above the furnace; but after this it burnt with great violence all the first night, and the people

* "Dentila is famous for its iron; the flux used for smelting the iron is the ashes of the bark of the *kino* tree. These ashes are as white as flour: they are not used in dying blue, and must therefore have something peculiar in them. I tasted them: they did not appear to me to have so much alkali as the mimosa ashes, but had an austere taste. The people told me, if I ate them I would certainly die."—M. Park, vol. ii. p. 65.

who attended put in at times more charcoal. On the day following the fire was not so fierce, and on the second night some of the tubes were withdrawn, and the air allowed to have free access to the furnace, but the heat was still very great, and a bluish flame rose some feet above the top of the furnace. On the third day, from the commencement of the operation, all the tubes were taken out, the ends of many of them being vitrified with the heat, but the metal was not removed until some days afterwards, when the whole was perfectly cool. Part of the furnace was then taken down, and the iron appeared in the form of a large irregular mass, with pieces of charcoal adhering to it. It was sonorous, and when any portion was broken off, the fracture exhibited a granulated appearance, like broken steel.

The owner informed him that many parts of this cake were useless, but still there was good iron enough to repay him for his trouble. This iron, or rather steel, is formed into various instruments, by being repeatedly heated in a forge, the heat of which is urged by a pair of double bellows, of a very simple construction, being made of two goats' skins, the tubes from which unite before they enter the forge, and supply a constant and very regular blast. The hammer, forceps, and anvil were all very simple, and the workmanship, particularly in the formation of knives and spears, was not destitute of merit. The iron he describes as hard and brittle, and that it requires much labour before it can be made to answer the purpose.

In the Himalaya Mountains, in Asia, iron is obtained by a smelting furnace of the following description:—It consists of a chimney, built of clay, about four feet and a half high, by fifteen to eighteen inches diameter, placed upon a stage of stone work, over a fire-place. In an opening below the stage there is a hole, through which the metal, when melted, flows, and this is stopped by clay or earth, easily removed by an iron poker. The ore, which is black, but glittering with metallic lustre (like black ore of antimony) is mixed with charcoal pounded, and the chimney filled with the mixture, and, as it falls and consolidates, more is added from above.

The fire, once lighted, is kept alive by means of two pair of bellows, each made of a goat's skin, fixed in some way to the stone stage, and filled through apertures closed with valves, as ours are; a woman or boy sits between two of these skins, and raises and compresses them alternately with the hand; four such skins are thus applied to each chimney.

The method pursued in the two former instances is extremely simple, but, at the same time, very uncertain, whilst that employed in the latter presents a decided improvement, by the application of the bellows, which, although of no great power, yet, by affording a regular blast, renders the operation more certain, and the manufacturer independent of the weather.

We shall, in the following pages, see the, at first, gradual, and, subsequently, from the great improvements in machinery, very rapid steps by which this manufacture has been placed in its present leading station amongst the staple commodities of this and of other countries. The very high degree of perfection to which it has attained, has not only rendered it suitable to a variety of purposes, to which, until lately, it was not considered applicable, but has also rendered it an extensive article of exportation to every part of the world, and of the very first use and importance to the agricultural and manufacturing interests of our own country.

We cannot do better than conclude this introductory chapter in the words of Locke:*—"Of what consequence the discovery of one natural body, and its properties, may be to human life, the whole great continent of America is a convincing instance; whose ignorance in useful arts, and want of the greatest part of the conveniences of life, in a country that abounded with all sorts of natural plenty, I think may be attributed to their ignorance of what was to be found in a very ordinary despicable stone—I mean the mineral of iron. And whatever we may think of our parts or improvements in this part of the world, where knowledge and plenty seem to vie with each other, yet, to any one that will

* "Essay on the Human Understanding," book iv. chap. 12.

seriously reflect on it, I suppose, it will appear past doubt, that were the use of iron lost among us, we should in a few ages be unavoidably reduced to the wants and ignorance of the ancient savage Americans, whose natural endowments and provisions come no way short of those of the most flourishing and polite nations. So that he who first made known the use of that contemptible mineral, may be truly styled the Father of Arts, and Author of Plenty."

CHAPTER II.

ENGLAND AND WALES.

HERODOTUS, who died about B. C. 414, tells us that "the Greeks knew the Phenicians fetched their tin from Britain." His remark establishes the fact of a trade of some standing; and can we suppose that the Britons during that intercourse, seeing the ships of their visitors, with all the usual requisites, iron arms and appointments, did not, even if before ignorant of iron and its uses, become fully instructed how to obtain it from its ores, and probably to form it into such things as they saw used, or as the Phenicians from accident or shipwreck might need to replace losses. More to confirm the preceding supposition, that the Britons knew and practised the manufacture of iron, we may remark, that Henry (in his Great Britain, vol. ii. p. 215, quoting Diod. Sic. lib. 5, sec. 22,) informs us that the Gauls were of the same origin, and spoke the same language as the ancient Britons, and that the Gaulish nations got possession of these coasts. It is unreasonable to suppose that a warlike nation should colonise Britain, and that the colonists should not bring with them their knowledge of iron and its uses in arms, &c., and at once labour to supply themselves. The Gauls were well skilled in mines. Strabo and Cæsar tell us in the Siege of Bourges, "they have great iron works, and every kind of mine."—See chap. x. on France.

The worship of Baal, apparent in the Druid worship, may originate from the Phenicians, and would seem to mark the intimate connection of the two people, and the consequent probability that they taught their arts also to the Britons. The Phenician exclusive trading with Britain appears to have lasted about 300 years, till interfered with by the

Greeks at about the time when Aristotle flourished (he *died* B. C. 322), and he speaks of the Britannic Isles. Pytheas, of Marseilles, 330 years B. C., seems the first of the Greeks who discovered the British Isles. That people speedily used the discovery, and commenced trading for tin, an article much in request both in Greece and Asia, and for which large dealings seem to have been carried on then, and previously for a long time by the Phenicians. This intercourse may have materially civilised the Britons, and have brought the nation to the degree of advancement it attained prior to the Roman invasion, which did not happen till after the lapse of about 250 years.

Polybius wrote, about 190 years B. C., a book now lost concerning Britain, and the management of tin there, a proof the Greeks traded there long before his day.—Henry, Great Britain, vol. ii. p. 209. The Syracusans certainly visited Britain up to B. C. 214, at which time they procured there and brought away a tree for a mainmast of the colossal ship of Archimedes.—Athen. Deipnos, lib. 5. c. 10.

The causes which operated to change the direct trading between the Greeks and Britons it seems difficult to determine, nevertheless they proved beneficial to the Gauls, through whose country, as we are informed (by Diod. Sic. l. 5, sec. 22, p. 347,) a vast trade of tin was conducted. The tin ingots were carried from Cornwall to the Isle of Wight, sold to the foreign merchants who resorted there, and by them were landed in Gaul, and taken overland in about a month to the mouth of the Rhone. The same writer states, "Those Britons (of the Land's-End, Cornwall), live in a very hospitable and polite manner, which is owing to their great intercourse with foreign merchants." Cæsar also states (De Bel. G. lib. 5, c. 13,) that before his time the trade of Britain, being carried on by the Gauls, the greatest number of ships from the Continent came to the Kentish ports, whose inhabitants were the most polite and conversant with foreign merchants.

Thus a mass of evidence brings us to the certainty that in this so civilized state of the Britons, they had acquired or

previously knew the art of mining well; and that iron making and manufacture of arms were known and practised, it seems impossible to disbelieve. Henry (Great Britain, vol. ii. p. 136,) writes, "it is abundantly evident that our British ancestors had discovered or been taught the art of working tin, lead, brass, and *iron* before invaded by the Romans." The truth of this is confirmed by Strabo, who mentions that iron was one of the exports of Britain, as well as corn, cattle, gold, and silver. Lib. iv. p. 200.*

Having resolved to punish the Britons for assisting the Gauls in their wars with him, the difficulty which Cæsar found to obtain information relating to Britain, before he ventured to present himself and army as invaders, led him to the conclusion that the merchants and others were acquainted only with the neighbourhood of the sea-coasts, and country opposite to Gaul (as mentioned Cæs. de Bel. G. lib. iv. c. 20); but it appears rash to adopt this inference, which his subsequent remarks seem not to justify. The jealousy of the Phenician traders in tin had, it may reasonably be inferred, descended to later merchants, and would render them also very silent when questioned as to the source of their profits, and the detail of British statistics. When, however, Cæsar tells us that the other parts of Britain were unknown by, and had no trade or intercourse with foreign nations, it is an assertion in some degree improbable, if we reflect on the variety and extent of the exports; and review his own subsequent remarks upon the military discipline, arms, and warlike opposition of the Britons to him; and also upon the knowledge and learning of the Druids, who sent the embassy to him after their knowledge of Volusenus' visit of observation, and Comius' return with those ambassadors. Cæsar's first invasion, (55 B.C.) was vigorously opposed, and after much fighting, and other battles of almost doubtful issue, Cæsar granted a peace, and *in less than a month* from the day of his landing left Britain. His next expedition in the following spring

* Henry, Great Britain, vol. ii. p. 269, 5th Edit. mentions that the Britons, at least a century before Cæsar's invasion, built small vessels, and exported their commodities to the Continent. Would not iron be employed here also?

arrived and landed, unopposed, at the same point, five legions and 2000 horse; after some twelve hours, he found the British, who attacked his army, and were worsted. Next ensued the grand contest with Cassibelaunus, whose cavalry and chariots charged the Romans vigorously; further engagements occurred at the Thames, but the Romans prevailed. Cassibelaunus still retained 4000 war-chariots, and his military skill was very remarkable. These war-chariots were armed with scythes and hooks, for cutting and tearing: they were terrible to the Romans, and Cæsar's account of the great skill of the British in the use of them, shews the progress of that people in the art of war, as also does his detail of the arms of their cavalry, long shields, broad swords, and long spears. This rehearsal of the accounts of Cæsar's invasion is here given to show that Cæsar himself proves to us that the British were not so uncivilised, and points to the fallacy of the notion that the British then had iron only in such very small quantities, that it was consequently made into money* and ornamental articles. Cæsar's first stay was about three weeks; his second about four months;† in both which (his narrative shows) his constant care and attention were requisite to maintain his footing, and he never extended his personal inspection far into the country, not beyond Verulam.‡ Bri-

* "Utuntur aut æreo, aut talcis ferreis, ad certum pondus examinatis pro nummo." Cæsar de Bel. Gal. lib. v. c. 12. They use either brass, or iron rings, and plates of a certain weight, for money.

Gough's "Camden," 1789.—Translated from the edition of 1607.

P. 65. "I have already observed from Cæsar that the ancient Britons used brass money, or iron rings, or plates of a certain weight, and some persons pretend to have seen some of them found in urns."

Mr. Edward Lluyd, in his travels through Cornwall, sent in a letter to Thomas Tonkin, Esq., dated Falmouth, Nov. 29, 1700, the outlines of two iron plates, whereof several horse loads were found about six years before. He queries whether they might not be the British money mentioned by Cæsar, on which Mr. Tonkin, M. S. B., p. 193, remarks:—"I am apt to believe Mr. Lluyd concludes rightly," and then adds—"This present year, 1730, as they were pulling down the great tower, and some very old buildings, at Boconnoc, the seat of the late Lord Bohun, about a peck of the same sorts, but of larger size, were found in parts of an old wall there."—Dr. Borlase engraved all these specimens in the second edition of his "Antiquities of Cornwall," p. 74.

† Cæsar quitted Britain, 26th Sept. 54 B.C.

‡ Strabo, lib. iv. p. 200.

tain had for 500 years been, as we have seen, a trading country, visited by Phenicians, Greeks, Gauls, and probably by several other nations, many of which must have been in turn visited by Britons, whose Druids, (famed for learning originating from Asia), we find, taught useful arts to the people. We have seen that the Gauls and this people were skilled in war and mining, in trading and agriculture, and why not in the reduction of their abundant iron ores to a large extent for their own uses, and for export, as before shown from Strabo.

The articles of luxury, gold chains, drinking glasses, amber cups, which he also mentions as imported for the use of the Britons, would shew advanced refinement among their princes.

We will now dismiss entirely this part of our subject, having, it is hoped, advanced proof that on comparing one part of Cæsar's narrative with others, we have elicited the truth, the only legitimate object of history.

The payment of tribute, which Julius Cæsar imposed on Britain, was never fully made, and Augustus did not enforce it except with threats, (B.C. 25, to A.D. 12—21.) but some princes did give tribute and presents. In Tiberius's reign, he accepted what was given in the same way, and there seems to have been a good understanding. Caligula's insane, useless adventure and invasion, A.D. 40, (Suetonius, in Calig. c. 44.) needs here no other notice. At the invasion (in the reign of Claudius) commanded by Vespasian, A.D. 43, arts seem to have made great advances,* and we remark, that their progress was continual to the year A.D. 61, when Suetonius, with his small army of veterans overcame all opposition, and gained his important victory over Queen Boadicea and her immense host. From this period the Romans appear to have retained possession of their dominion, and introduced, wherever they saw fit, the manufacture of such things as they needed. The seven campaigns of Agricola,† to A.D. 84, offer nothing in aid of our object than the knowledge of his unremitted attention

* Tacitus, Annal. lib. xiv. c. 33. London was at this time a great city of trade, and merchants, and shipping.

† Agricola lived six whole years in Britain, and visited every part.

to promote arts and civilization everywhere, so stimulating the Britons to improve themselves.

The Emperor Adrian passed over into Britain in the year of our Lord 120, accompanied by the sixth legion; part of this body of troops was stationed at Bath, as may be inferred from two sepulchral *cippi*, discovered there some years since, commemorating an officer of this legion. During the year ensuing his arrival, the *fabrica*, or great military forge, was, probably by his directions, established at Bath. No other time is so likely for its erection as the interval during which Adrian remained in this country. These advantageous establishments had been lately introduced amongst the Romans, and different parts of the empire already had their *fabricæ*, from which immense utility was found to be derived. It is reasonable, therefore, to suppose, that an Emperor like Adrian, attentive to warlike affairs, skilled in tactics, versed in military discipline, passionately fond of his legions, ever desirous to promote their convenience, and assist their improvements, would transport into Britain, as early as possible, an establishment from which such numberless advantages had been produced on the Continent. Bath would be a spot of all others calculated for such an edifice; contiguous to the hills of Monmouthshire and Gloucestershire, where iron ore was found in the utmost plenty, and centrical in situation for the distribution of the arms, which were made at its furnaces, to every part of the kingdom.

The *fabrica* of which we are speaking was a college of armourers, where the various military weapons used by the Roman soldiers were manufactured. The business of this society, and the laws which regulated it, are developed by the Theodosian and Justinian codes. It there appears that, towards the commencement of the second century, the army smiths were created into companies, each governed by its own president or head, denominated the *primicerius*. That the employment of these bodies was to make arms for the use of the legion or legions to which it was attached, at public forges or shops, called *fabricæ*, erected in the camps, cities, towns, or military stations; that these arms, when forged,

were to be delivered to an officer appointed to receive them, who laid them up in arsenals for public service; that to prevent any abuse in this important branch of military economy, and to insure its proper and methodical management, no person was permitted to forge arms for the imperial service, unless he were previouly admitted a member of the society of the Fabri; that, to secure the continuance of their labours after they had been instructed in the art, a certain yearly stipend was settled on each armourer, who (as well as his offspring) was prohibited from leaving the employ till he had attained the office of *primicerius;* and, finally, that no one might quit his business without detection, a mark or *stigma* was impressed upon the arm of each as soon as he became a member of the *fabrica.*

These colleges were of two sorts, the smaller and greater, the latter called, by way of excellence, *fabricæ sacræ.* Not attached to any particular legion, the *fabricæ sacræ* supplied whole provinces, and sometimes whole kingdoms, with military weapons. Of this kind the college at Bath is, with good reason, supposed to have been; furnishing arms not only to the garrison of the colony, but to the troops at Caerleon, Chester, and Ilchester, and to the whole army and line of stations throughout Britain, and to some bodies of Roman soldiers on the Continent. An establishment of this nature would add considerably to the consequence of Bath, which now became a scene of bustle and business. The road connecting it with the opposite side of the Severn was enlarged and repaired, as it supplied the forges with the iron manufactured at them, which, dug up in the Forest of Dean, and in the hills of Monmouthshire, was transported across the river at Lydney, landed at Aust, and brought to Bath by a military way, running nearly parallel with the upper Bristol road. The constant demand for military weapons from all parts of the kingdom gave an additional life and spirit to the city; its intercourse became general, and the roads which branched from it, in every direction, were crowded with vehicles that conveyed to different places the various destructive implements of war made at its *fabrica.*

The wise, vigilant, and accomplished Adrian, during his stay, was active and diligent in improving the people; from his time, his successors continued to work the iron mines, till the final abandonment of Britain, by the Romans, about A. D. 409.

Immense beds of iron cinders, relics of the Romans, have been discovered in the Forest of Dean, in Monmouthshire. Four miles north-west of Bolston Gaer, which lies near Miskin, the seat of William Bassett, Esq., under a large bed of cinders, a coin of Antoninus Pius was found in 1762, together with a piece of fine earthenware, charged with greyhounds, hares, &c., which the workmen broke to pieces. In Yorkshire, and other counties,* cinders have also been discovered accompanied with coins, all which evince the frequency of iron foundries during the period of the Roman reign in Britain.†

The Romans introduced iron foundries in Siluria, at Monmouth, Hadnock, Keven Pwlldu, and other parts of the country.‡ To the disturbed state of the country after the Romans left Britain, is to be attributed the suspension of the production of iron.

The conquest of Britain by the Saxons, a tedious and bloody era, seems to have been at first nearly destructive of all energy in the arts, and especially as relates to mines and making of iron; yet we cannot be surprised at the honour bestowed by the Anglo Saxons, on artificers who excelled in fabricating swords, arms, and defensive armour, (Wilkins, Leges Sax. p. 25.) all persons being required by law to have arms.

In the history of the five kings of England, from the union

* Our iron mines were as well known to the Romans, as those of lead, as appears from an altar discovered at one of their walled towns, Condercum, or Benwell, inscribed to Jupiter Dolichenus, the deity who presided over this metal.—*Wallis's Nat. Hist. Northumberland*, vol. i. p. 118.

† Musgrave, in his "Belg. Brit." cap. xiii. sec. 4. says—"As regards iron, the best and worst instrument of life, it is manifest that, in the time of the ancients, it was produced in the country of the Silures (inhabitants of South Wales), and melted in furnaces, which the half burnt ashes to be seen in it at this day in great abundance, and the altar of Calpurnius, raised to Jupiter Dolicheous, as protector of iron works, in our time in a state of ruin, testify."

‡ Williams's History of Monmouthshire.

of the Heptarchy by Ecbert's conquest, we have sought unsuccessfully for information upon our subject.

The Danes having been at length subdued by Alfred, that excellent monarch, being at peace twelve years, did all he could to improve trade, naval power, and the arts, among his subjects ; but we do not discover either in this reign or in that of his son Edward, or grandson Athelstan, (who died, 941,) any matter in aid of our history of iron.

The same may be also said of the succeeding seven reigns, to Canute the Great, (18th king of England, who died, A.D. 1036,) who, having subjected England, wisely resuscitated commerce and the arts. As no particular mention is made of iron, in this and the reigns of four succeeding monarchs to the conquest, it is uncertain to what extent the manufacture was carried on; but Camden states, that in and before the reign of William the Conqueror, the chief trade of the city of Gloucester was forging of iron; and it is mentioned in Doomsday book, that there was scarcely any other tribute required from that city, by the king, than certain dicars of iron, and iron bars, for the use of the royal navy. The quantity required was thirty-six dicars of iron—a dicar, containing ten bars, and one hundred iron-rods for nails or bolts.

Giraldus Cambrensis, who lived in the twelfth century, says "the Forest of Dean amply supplies Gloucester with iron."

During the period from the Conquest to the death of John, iron and steel were imported into Britain from Germany and other countries; the "German merchants of the steel-yard" are thought by some to have derived that name from the great quantities of iron and steel which they imported, and sold at a place called the *steel-yard*. The art of making defensive armour was, during the same period, brought to such perfection, that a knight completely armed was almost invulnerable.

In the north of England mines were very rare ;* there were so few in the reign of Edward the Third, that the governor of Berwick-upon-Tweed, in the year 1376, was obliged to send

* Holl. Chron.

for miners from the Forest of Dean, and the more southern parts, to assist him in retaking the town from the Scots. And in the tenth year of the preceding reign (Edward the Second), iron mines were so scarce, that the Scots, in a predatory expedition which they made in that year, met with no iron worth their notice until they came to Furness, in Lancashire, where they seized all the manufactured iron they could find, and carried it off with the greatest joy, though so heavy of carriage, and preferred it to all other plunder.

By an Act passed in the twenty-eighth year of Edward the Third, no iron manufactured in England, and also no iron imported and sold, could be carried out of the country, under the penalty of forfeiting double the quantity to the king; and the magistrates were empowered to regulate the selling price and to punish those who sold at too dear a rate, according to the extent of the transaction.

Although the art of forging iron had been so long, and so extensively in practice, there is no trace of the precise period at which the art of casting was discovered; in the year 1327, we hear of cannon, which are then supposed to have been first used in England, by Edward the Third, in his invasion of Scotland.

That fire-arms were used in France about the same time, appears from the following article in the accounts of the Treasurer of War, A. D. 1338. "To Henry de Faumichan, for gunpowder and other things necessary for the cannon, at the siege of Puii Guillaume.*"

Edward the Third had cannon with his army at the famous battle of Cressy, and still more famous siege of Calais, in the year 1346.

The illustrious Petrarch, in one of his dialogues on the remedies of good and bad fortune, which were written A. D. 1358, speaks of cannon as a comparatively new invention.—

"G.—I have cross-bows, and other machines of war.

"R.—I am surprised that you have not also some of those instruments which discharge balls of metal with most tremen-

* Henry's Great Brit.

dous noise, and flashes of fire. These destructive plagues were, a few years ago, very rare, and were viewed with the greatest astonishment and admiration, but now they are become as common and familiar as any other kind of arms. So quick and ingenious are the minds of men in learning the most pernicious arts."

Cannon, or, as they were then called, *bombards*, were all made of iron, until about the middle of the fifteenth century, when a mixed metal, called font-metal, or bronze, was invented. In 1378, Richard the Second gave a commission to Thomas Norwich, to buy two great and two small cannon in London, or any other place. Besides great guns, a smaller kind of fire-arms, called "hand-cannon," came into use at this time. They were so small and light, that one of them was carried by two men, and fired from a rest fixed in the ground. The 400 cannon, or the greatest part of them, with which an English army besieged St. Malo, in 1378, must have been of this kind.

During the fourteenth and fifteenth centuries, iron and steel were imported from Germany, Prussia, and other places, and also iron from Spain. But as several improvements in the manufactures had taken place in the course of this period in England, laws were made towards the end of it, against importing any of the articles manufactured in this country in iron and steel. Upon a petition to the House of Commons, A. D. 1483, from the manufacturers of London and other towns, representing the great damage they sustained by the importation of the articles which they manufactured, an Act was passed against the importation of knives, hangers, tailors' shears, scissors and irons, fire-forks, gridirons, stock-locks, keys, hinges and garnets, spurs, bits, stirrups, buckler-chains, latten-nails with iron shanks, buckles for shoes, shears, iron-wire, iron candlesticks, grates, and other articles of home production.

We are without any particular information respecting the progress made in the manufacture of iron, until the reigns of Elizabeth and James the First; there is no doubt, however, of the works having materially increased in many parts of the

country, and particularly in Sussex. We learn from Leland, speaking of the Forest of Dean, that "the ground is fruitful of iron mines, and divers forges there to make iron;" also, in Somersetshire, "iron ore found of late at Mendip, and iron made there." In Camden, we find "Sussex is full of iron mines everywhere, for the casting of which there are furnaces up and down the country, and abundance of wood is yearly spent; many streams of water are drawn into one channel, and a great deal of meadow ground is turned into pools, for the driving of mills by the flashes, which, beating with hammers upon the iron, fill the neighbourhood night and day with their noise. But the iron here wrought is not everywhere of the same goodness, and, in general, more brittle than Spanish iron. It yields, however, no small profit to the proprietors of the mines, who cast cannon and other articles in it." He also mentions Yorkshire and Staffordshire—of the former, "Sheffield, remarkable, among many other places hereabouts, for blacksmiths, there being much iron digged up in these parts;" of the latter—"the south, which has much pit-coal and mines of iron, but whether more to their loss or advantage, the natives themselves are the best judges, and so I refer it to them."

In 1558 an Act was passed that timber should not be felled to make coals for burning iron. It was enacted that no timber, of the breadth of one foot square at the stub, and growing within fourteen miles of the sea, or of any part of the rivers of Thames, Severn, or any other river, creek, or stream, by the which carriage is commonly used by boat, or other vessel, to any part of the sea, shall be converted to coal, or fuel, for the making of iron. This Act not to extend to the county of Sussex, nor to the weald of Kent, nor to any of the parishes of Charldwood, Newdigate, and high in the weald of the county of Surrey.—1 *Eliz. c.* 15.*

* Iron wire, in England, was, before 1568, all made and drawn by main strength alone. In the Forest of Dean, and elsewhere, the Germans then introduced the art of drawing it by a mill. The greatest part of the iron wire, and ready-made wool cards, had been hitherto imported.—*Gough's Camden* (additions).

The iron and wire works, near Abbey Tintern, were erected by Germans.—*D. Williams's History of Monmouthshire.*

In 1581 a further Act was passed, to prevent the destruction of timber, setting forth that, by reason of the late erection of sundry iron-mills, in divers places of this realm, not far distant from the city of London, and the suburbs of the same, or from the downs and sea-coasts of Sussex, the necessary provision of wood, as well timber fit for building, and other uses, as also all other fellable wood serving for fuel, doth daily decay and become scant, and will in time to come become much more scarce, by reason whereof the prices are grown to be very great and unreasonable. For remedy whereof, it was enacted, that no new iron-works should be erected within twenty-two miles of London, nor within fourteen miles of the river Thames, nor in the several parts of Sussex near the sea therein named, neither should any wood within the limits described, be converted to coal, or other fuel for making of iron.—This Act not to extend to the woods of Christopher Darrell, in the parish of Newdigate, within the weald of Surrey, which woods have been, and are preserved and coppiced by him, for the use of his iron-works in those parts.—23 *Eliz. c.* 5.

A subsequent Act prohibited the erection of any new iron-works in Surrey, Kent, and Sussex, and ordered that no timber, of the size of one foot square at the stub, should be used as fuel at any iron-work.—27 *Eliz. c.* 19.* †

* Godfrey Box, of Liege, set up at Dartford, in the year 1590, the first iron mill for slitting bars.—*Gough's Camden* (additions).

† In the Stradling Correspondence, edited by the Rev. J. Montgomery Traherne, we find the following letter on the scarcity of iron in Glamorganshire in the reign of Queen Elizabeth, 1586.

"*To the right wor. my very good cosen Sr. Edwarde Stradling, Knighte.*

"Sr., I am entreated by Robert Hensley, the bearer herof, to enforme you of the trooth of a bargayne betwine him and one Thomas Sulley, late of St. Athens of yor neere neighbourhoode, touchinge an anvyle wch he did sett unto the sayd Sulley for a yere. The bargayne is witnessed by two p'sons, viz. John Wattes, clerke, minister of Porlocke, and John Bearde of Selworthye, who sayeth that, about our Lady-day last past, Robt. Hensley did sett to heire the sayd anvyle to the sayd Thomas Sulley at a rent of iiis. iiii*d*. for the yere; with further condicon that yf the sayd Robert, or any of his brothers, woulde require to have agayne the sayd anvyll into theire possession wthin the sayd yere, then, upon one qrter's warninge, the sayde anvyle was to be restored, and he to abate of the rente according to the tyme that he possessed

The scarcity of fuel for the iron-works being now severely felt, persons interested in the manufacture naturally turned their attention to the subject, with a view to find a substitute, if possible, for that fuel of which they had been deprived ; and attempts were made by many persons, in the reigns of James the First and Charles the First, to smelt iron with pit-coal, but without success; and, consequently, the iron-works in many parts of the country were stopped entirely, and in other parts materially decreased.

The following account, taken from the *Metallum Martis*, of Dudley, published in the reign of Charles the Second, gives a full and interesting history of his own various experiments for the smelting of iron with pit-coal. It commences with an epistolatory dedication to the king, which is followed by a long prefatory epistle to parliament, wherein, amongst other information, petitions, &c., he says :—

"My dear Master,—Our sacred martyr, Charles the First of ever blessed memory, did animate the author, by granting him a patent in the fourteenth year of his reign, for the making of iron, and melting, extracting, refining, &c., all minerals and metals with pit-coal, sea-coal, peat, and turf, which was extinct, and obstructed by this unnatural and unparalleled war." This concluded with a letter:

"To the reader, especially of England, Scotland, and Wales:

"The injury and prejudice done unto me, and to this island, my native country, for the making of iron with pit-coal, &c., moved me, in the negligence of better wits and pens, to apologise for it in the ensuing treatise; and believe me, reader,

the same. The ptyes yt dothe testifie this bargayne are honest and credible; wherfore I beseech yow extend yor lawfull favor to my honeste countreyman accordinge to the equitye of his cause: so shall you have me ever ready to requite you or any neighbour of yors in the like cause, or greater, as occasion shall move.

"Thus, making to you and to my good ladye my right harty comendacons, doe take my leave of you.

"Att my house, Combsydenham, this xxixth of June 1586.

"Yor very loving frend and cosen,

"George Sydnaham."

it was no private or political design in my invention, but mere zeal, becoming an honest man, *Patriæ, parentibus, et amicis,* that engaged me, after many others failed in these inventions, for the general good, and preservation of wood and timber, which,

> Æque pauperibus locupletibusque,
> Æque neglectis pueris senibusque nocebit.

"DUD. DUDLEY."

He then proceeds:—"Having former knowledge and delight in iron-works of my father's, when I was but a youth, afterward, at twenty years old, was I fetched from Oxford, then of Baliol College, *anno* 1619, to look over and manage three iron-works of my father's, one furnace, and two forges, in the chase of Pensnet, in Worcestershire; but, wood and charcoal growing very scanty, and pit-coals, in great quantities, abounding near the furnace, did induce me to alter my furnace, and to attempt, by my new invention, the making of iron with pit-coal, assuring myself, in my invention, the loss to me could not be greater than others, nor so great, although my success should be fruitless; but I found such success at first trial as animated me, for, at my trial, or blast, I made iron to profit with pit-coal, and found *facere est addere inventioni.* After I had proved by a second blast and trial, the feasibility of making iron with pit-coal and sea-coal, I found by my new invention the quality to be good and profitable, but the quantity did not exceed above three tons per week, though I doubted not in future to have advanced my invention to make quantity also.

"Immediately after my second trial, I wrote to my father what I had done, and, withal, desired him to obtain a patent for it from King James, of blessed memory; the answer to which letter I shall insert, only to show the forwardness of King James, in this his much animating the invention, as did others—

"'SON DUDLEY,—The King's Majesty being at Newmarket, I sent Parkes thither on Saturday, to some friends of mine, to move the King's Majesty for my patent; which he,

coming on Sunday morning, in the afternoon his Majesty sent a warrant to Master Attorney to dispatch my patent, for the which I am infinitely bound unto his Majesty, that it pleased him, of his great grace and favour to dispatch it so soon. I have been this night with Master Attorney, who will make haste for me. God bless you, and commend me unto all my friends.

"'Your loving father,

"'EDWARD DUDLEY.'

"This Richard Parkes, of Parkhouse, Esquire, in the letter before-mentioned, was the author's brother-in-law, which did, about one year after the patent was granted, carry from the author much good merchantable iron unto the Tower, by King James' command, to be tried by all artists, who did very well approve of the iron; and the said Parkhouse had a fowling gun there, made of pit-coal iron, with his name gilt upon the gun, which gun was taken from him by Colonel Leveson, Governor of Dudley Castle, and never restored.

"The said Richard Parkhouse's son, my nephew, Edward Parkhouse, the 5th January, 1644, pressed me much to put pen unto paper to what I have done in the invention of making iron with pit-coal and sea-coal, not unknown unto this country, and to my brother Folliott, Esquire, and my nephew Parkhouse, Esquire, and to my kinsman, Master Francis Dingby, to whom I intend to leave the secrets of my inventions. Notwithstanding all my sad sufferings from time to time, these forty years, in the inventions, my sufferings in the war, and my estate sold for my loyalty, and also my sad sufferings and obstructions since his Sacred Majesty's happy restoration, many ways; and also upon sundry and many references, at the author's very great charge, pains and time spent, of four years, in his aged days, for the general good, by his invention for the preservation of Great Britain's wood and timber. Now, let me show some reasons that induced me to undertake these inventions after the many failings of others, well knowing that, within ten miles of Dudley Castle,

there be near 20,000 smiths of all sorts, and many iron-works at that time, within that circle, decayed for want of wood (yet formerly a mighty woodland country). Secondly, the Lord Dudley's woods and works decayed, but pit-coal and ironstone, or mines, abounding upon his lands, but of little use. Thirdly, because most of the coal mines in these parts, as well as upon Lord Dudley's lands, are coals, ten, eleven, and twelve yards thick, the top or the uppermost coal, or vein, gotten upon the superficies of this globe or earth in open works. Fourthly, under this great thickness of coal are very many sorts of ironstone mines, in the earth, clay, or stone earth, like bats, in all four yards thick; also under these iron mines are several yards thick of coals, but of these in another place more convenient. Fifthly, knowing that, when the colliers are forced to sink pits for getting of ten yards thick or more, one-third part of the coals that be gotten under the ground being small, are of little or of no use in that inland country, nor is it worth the drawing out of the pits, unless it might be made use of by making of iron therewith into cast works or bars. Sixthly, then, knowing that, if there could be any use made of the small coals that are of little use, then would they be drawn out of the pits, which coals produced oftentimes great prejudice unto the owners of the works and the work itself, and also unto the colliers, who, casting of the small coals together, which compelling necessity enforcing the colliers so to do, for two causes, one is to raise them to cut down the ten yards thickness of coals, drawing only the bigger sort of coal, not regarding the lesser or small coal, which will bring no money, saying—he that liveth longest let him fetch fire furthest. Next, these colliers must cast these coals and slack or dross out of their ways, which sulphurous small coal and crowded moist slack heat naturally, and kindle in the middle of these great heaps, often sets the coal works on fire, and flaming out of the pits, and continue burning, like Ætna, in Sicily, or Hecla, in the Indies.

"Yet, when these loose sulphurous composts of coal and slack being consumed in process of time, the fire decays; but, notwithstanding the fire hath continued in some pits many

years, yet colliers have gotten coals again in those same pits, the fire not penetrating the solid and firmer wall of coals, because, *pabulum ignis est aer*, the air could not penetrate, but pass by it in the loose coal and slack, for coming into those pits afterwards, I have beheld the very blows of pikes or tools, that got the coal there formerly. Also from these sulphurous heaps, mixed with ironstone (for out of many of the same pits is gotten much ironstone or mine), the fires heating vast quantities of water, passing through these soughs or adits becometh as hot as the bath at Bath, and more healing and sovereign even for old ulcers and sores, because many of these baths proceed not only from common sulphur and vitriol of *Mars*, but also from *Solar* sulphur in this ironstone. I hope *filii artis* will excuse my digression from the making of iron with pit-coal, sea-coal, peat, or turf, and the melting of mines and metals, and refining of the same with the like fuel. The first patent being granted by King James, for thirty-one years, in the nineteenth year of his reign, upon just and true information, that the author had, the year before, made many tons of iron with pit-coal, at a furnace, or iron-work, in the chase at Pensnet, county of Worcester, besides cast-iron works of sundry sorts, with pit-coal; and also at two forges, or iron-mills, called Cradley Forges, fined the said iron into merchantable good bar-iron. But the year following the grant, or patent, for making of iron with pit-coal or sea-coal, there was so great a flood by rain—to this day called 'the great May-day flood'—that it not only ruinated the author's iron-works and inventions, but also many other men's iron-works; and at a market town, called *Sturbridge, in comitatu Wigorniæ*, although the author sent with speed to preserve the people from drowning, one resolute man was carried from the bridge there in the daytime; and the nether part of the town was so deep in water, that the people had much ado to preserve their lives in the uppermost rooms in their houses.

"My iron-works and inventions thus demolished, to the joy of many ironmasters, whose works escaped the flood, and who had often disparaged the author's inventions, because the author sold good iron cheaper than they could afford it, and

which induced many of the ironmasters to complain unto King James, averring that the iron was not merchantable. As soon as the author had repaired his works and inventions, to his no small charge, they so far prevailed with King James, that the author was commanded, with all speed possible, to send all sorts of bar-iron up to the Tower of London, fit for making of muskets and carbines; and the iron being so tried by artists and smiths, that the ironmasters and ironmongers were all silenced, until the twenty-first of King James. At the then Parliament all monopolies were made null, and divers of the ironmasters endeavoured to bring the invention of making iron with pit-coal, &c., within the compass of a monopoly; but the Lord Dudley and the author did prevail, yet the patent was limited to continue but fourteen years.* After which Act, the author went on cheerfully, and made annually great store of iron, good and merchantable, and sold it unto divers men, yet living, at 12*l.* per ton. I also made all sorts of cast-iron wares, as brewing-cisterns, pots, mortars, and better and cheaper than any yet were made in these nations, with charcoal; some of which are extant, to be seen by any (at the author's house, in the city of Worcester) that desire to be satisfied of the truth in the said invention.

"Afterwards, the author was ousted of his works and inventions before-mentioned, by the ironmasters and others, wrongfully—over long to relate; yet, being unwilling his inventions (having undergone much charge and pains therein) should fall to the ground, and be buried in him, made him set forward his inventions again, at a furnace called Himley fur-

* "Provided also, and be it declared and enacted, that this Act, or any declaracion, provision, penaltie, forfeiture, or other thing before mencioned, shall not extend to or be prejudiciall to a graunt or priviledge for or concerning the melting of iron ewer, and of making the same into cast-workes or barres, with seacoales or pit-coales, by his Majisties lettres patent, under the Great Seale of England, bearing date the twentith day of Februarie, in the nyneteenth yeare of his Majisties Raigne of England, made or graunted to Edward Lord Dudley, but that the same severall lettres patent and graunte shalle and remayne of the like force and effect, and as free from the declaracions, provisions, penalties, and forfeitures before mentioned, as if this Act had never byn had nor made, and not otherwise."

21 Jac. I, c. 3. "*Statute of Monopolies.*"

nace, in the county of Stafford, where he made much iron with pit-coal; but, wanting a forge to make it into bars, was constrained, for want of stock, to sell the pig-iron unto the charcoal ironmasters, who did him much prejudice, not only in detaining his stock, but also disparaging the iron—Himley furnace being rented out unto charcoal ironmasters.

"The author erected a new large furnace on purpose, twenty-seven feet square, all of stone, for his new invention, at a place called Hascobridge, in the parish of Sedgeley, and county of Stafford; the bellows of which furnace were larger than ordinary bellows are; in which work he made seven tons of iron per week, the greatest quantity of pit-coal iron that ever yet was made in Great Britain. Near which furnace the author discovered many new coal mines, ten yards thick, and iron mine under it, according to other coal works; which coal works being brought into perfection, the author was, by force, thrown out of them, and the bellows of his new furnace and invention, by riotous persons, cut in pieces, to his no small prejudice, and loss of his invention of making of iron with pit-coal, &c., so that being, with law-suits and riots, wearied and disabled to prosecute his art and invention at present, even until the first patent was extinct.

"Notwithstanding the author's sad sufferings—imprisoned wrongfully for several thousand pounds, in the Counter, in London, yet did obtain a new patent, dated May 2, *anno* 14 *Caroli Primi*, of ever blessed memory, not only for the making of iron into cast works and bars, but also for the melting, extracting, refining, &c., all mines, minerals, and metals, with pit-coal, sea-coal, &c., for the preservation of the wood and timber of this island; into which patent the author for the better support and management of his invention, so much opposed formerly at the Court, at the Parliament, and at the Law, took in David Ramsey, Esq., resident at the Court, Sir George Horsey, at the Parliament, Roger Foulke, Esq., a counsellor of the Temple, and an ingenious man, and also an ironmaster, my neighbour, and one who did well know my former sufferings, and what I had done in the invention of making of iron with pit-coal, &c. All which patentees articled

the 11th June following the grant, not only to pay the author all the charges of passing the patent laid down by him, but also to lay in, for a common and joint-stock, each man of the four, one hundred pounds, and so from time to time what more stock any three of the patentees should think fit to be laid in, for the making of iron into cast works and bars, and likewise for the melting, &c., with pit-coal, &c. (as above)—which articles are yet extant.

"Now, let me, without offence, insert the opposition we all had, by means of powerful ironmasters, with Sir Philibeard Vernat, a Dutchman, and Captain Whitmore, who pretended much unto his Majesty, but performed not their undertaking, which caused the author and his partners thus to petition:—

"'To the King's Most Excellent Majesty.

"'The humble petition of Sir George Horsey, Knt., David Ramsey, Roger Foulke, and Dud Dudley, Esquires, humbly showeth—That whereas your petitioners being called before the Right Honourable the Lord Keeper, by your Majesty's appointment, touching the making of iron with pit-coal, &c., for which they have your Majesty's patent; and seeing that Sir Philibeard Vernat, and Captain Whitmore, who are not inventors, have obtained a patent also for the same; yet, before the patent granted, Sir Philibeard was ordered at council board, according to his great undertaking, to perfect it, and his invention within two years; and there hath been near three years passed, and yet have made little or no iron; still he opposeth your petitioners, and doth neither benefit himself, but hinders your Majesty and the kingdom.'

"At the Court at Greenwich, May 20th, 1638, his Majesty is pleased to refer this petition to Master Attorney and Master Solicitor-General, to call the petitioners before them, and to compose the differences between them, if they can—or otherwise to certify his Majesty their opinions therein.

"Sir Sidney Montague was then Master of the Requests, but Sir Philibeard Vernat and Captain Whitmore, never appeared any more for their invention.

"Not long after the wars came on, and caused my partners

to desist, since which they are all dead but the author; and his estate (for his loyalty unto his late Sacred Majesty and master), as by the additional Act of Parliament may appear, was totally sold. Yet, nevertheless, I still endeavoured not to bury my talents, took in two partners into my inventions—Walter Sevens, of Bristow, linendraper, and John Stone, of the same city, merchant. After the author had begun to erect a new work for the inventions aforesaid, near Bristow, *anno* 51, and there we three partners had in stock near 700*l.*; but they not only cunningly drew me into bond, entered upon my stock and work, unto this day detained it, but also did unjustly enter staple actions in Bristow, of great value against me, because I was of the King's party, unto the great prejudice of my inventions and proceedings, my patent being then almost extinct; for which, and my stock, am I forced to sue them in Chancery.

"In the interim of my proceedings, Cromwell and the then Parliament, granted a patent and an Act of Parliament unto Captain Buck, of Hampton-road, for the making of iron with pit-coal and sea-coal. Cromwell, and many of his officers, were partners, as Major Wildman and others; many doctors of physic, and merchants, who set up divers and sundry works and furnaces, at a vast charge, in the Forest of Dean, and after they had spent much in their invention and experiments, which was done in spacious wind-furnaces, and also in pots of glass-house clay, and failing, afterwards got unto them an ingenious glass-master, Edward Dagney, an Italian, then living in Bristow, who, after he had made many pots for that purpose, I went with them into the Forest of Dean, and built for the said Captain Buck and his partner a new furnace, and made therein sundry experiments and trials for the making of iron with pit-coal and sea-coal; but he failing, and his pots being all broken, he did return to Bristow frustrate of his expectation, but further promising to come again and make more experiments; at which time, Master John Williams, Master Dagney's master of the glass-house, was then drawn in to be a partner for 300*l.* deposited, and most of it spent. The said Williams and Dagney hearing that the author had

knowledge in the making of iron with pit-coal, sea-coal, &c., they, from Captain Buck, and the other partners, importuned the author, who was at the time in great danger by the Parliament, being a colonel of the king's party, to go along with them into the Forest of Dean, which at that time durst not deny coming thither. I observed their manner at working, and found it impossible that the said Edward Dagney, by his inventions, should make any iron with pit-coal or sea-coal, in pots, to profit. I continued with them till all their pots and inventions failed. At every dinner and supper, Captain Buck, Captain Robins, Doctor Ivie, Doctor Fowler, and others, would ask the author why he was so confident that iron in quantity could not be made by their new inventions? I found it a difficult thing to dissuade the partners from their way, so confident were they to perform the making of iron with pit-coal or sea-coal to profit, that they desired me to come again a second time into the forest to see it effected; but at that time I saw their failings also, yet, nevertheless, Captain Buck and his partner erected nine works, at the city of Bristow, in which they did fail as much as in their former inventions.

"But Captain Wildman—more barbarous to me than a wild man—although a minister, bought the author's estate, near 200*l.* per annum, intending to compel from the author his inventions of making of iron with pit-coal; but afterwards passed my estate unto two barbarous brokers of London, that pulled down the author's two mansion houses, sold 500 timber trees off his land, and to this day are his houses unrepaired, *anno* 1655. Captain Buck and his partner, wearied of their invention, desisting *anno* 1656. Captain John Copley, from Cromwell, obtained another patent for the making of iron with pit-coal and sea-coal; he and his partner set up their works at the coal works near Bristow, and endeavoured by engineers' assistance to get his bellows to be blown at or near the pits of coal, with which engines the work could not be performed. But the author coming to see the said works, and after many discoveries with Captain Copley, his former acquaintance, told him plainly if his bellows could have been blown with those engines, yet I feared he could not make iron with pit-coal or

sea-coal; he seemed disconcerted, whereupon, and without these engines, I made his bellows to be blown forcibly, as by the note under his hand appears, as followeth :—

"'1656, December 30.—Memorandum, the day and year above written: I, John Copley, of London, gent., do acknowledge that after the expense of divers hundred pounds to engineers, of the making of my bellows to blow, for the making of iron with pit-coal or sea-coal, near Bristow, and near the Forest of Kingswood, that Dud Dudley, Esq., did perform the blowing of the said bellows at the works or pits aforesaid, a very forcible and plausible way, that one man may blow them with pleasure the space of an hour or two; and this I do acknowledge to be performed with a very small charge, and without any money paid to him for the said invention. 'JOHN COPLEY.'

"Captain John Copley thus failing in his inventions, *anno* 1657, so he went into Ireland, and all men now desisting from the inventions of making iron with pit-coal and sea-coal, the author, *anno* 1660, being sixty-one years of age, and moved with pity, and seeing no man able to perform the mastery of making of iron with pit-coal or sea-coal, immediately upon his Sacred Majesty's happy restoration, the same day he landed, petitioned that he might be restored to his place, and his patent, obstructed, revived, for the making of iron with pit-coal, sea-coal, peat, and turf, into cast work and bars, and for the melting, extracting, refining, and reducing of all mines, metals, and minerals with pit-coal, sea-coal, peat, and turf—which said laudable inventions the author was, and is, unwilling should fall to the ground and die with him; neither is the mystery or mastery of the inventions effected and perfected by any man known unto the author as yet, either in England, Scotland, or Wales, all which three abound with pit-coal or sea-coal, and do over much furnish other kingdoms, many with pit-coal and sea-coal, when they might make better use of it themselves (especially Scotland and Wales) both for the making iron into cast works and bar, and also for the making of steel, and melting, extracting, and refining of lead, tin, and iron.

"The author petitioned his Sacred Majesty sitting at the council board, for the renewing of his patent; the reference to that petition followeth:—

"The author during the Lords Commissioners' their time, could get no order upon his references, but his petition was left with the new Right Honourable the Lord Treasurer, to take or grant from their order therein, but the author hath gotten hitherto no order, therefore compelling necessity doth constrain (having prosecuted his petition hitherto) him to desist from his inventions, in which he hath taken more pains, care, and charge than any man to perfect his new inventions in these kingdoms. Although the author hath not as yet so fully perfected or raised his inventions to the quantity of charcoal iron furnaces, yet the author's quantity being but seven tons per week at the most, together with the quality of his iron made with pit-coal and sea-coal, hath the most eminent triplicity of iron of all that can be desired in any new invention:—1. More sufficient—2. More cheap—3. More excellent—upon which triplicity the author might enlarge, but shall not be tedious, only give me leave to mention that there be three sorts of cast-iron. 1. The first sort is grey iron.—2. The second sort is called motley iron, of which one part of the sows or pigs is grey—the other part is white intermixed.—3. The third sort is called white iron; this is almost as white as bell metal, but in the furnace is least fined, and the most terrestrial.

"Of the three, the motley iron is somewhat more fined, but the grey iron is most fined in the furnace, and more malleable and tough than the other two sorts before mentioned, and of this sort is the iron made with pit-coal (sea-coal for the most part), and therefore more sufficiently to be preferred.—2. More cheap iron there cannot be made, for the author did sell pig or cast-iron made with pit-coal at 4*l.* per ton; many tons in the twentieth year of King James, with good profit. Also, the author did sell bar iron, good and merchantable, at 12*l.* per ton, and under; but bar-iron hath been sold for the most part ever since, at 15*l.*, 16*l.*, 17*l.*, and 18*l.* per ton, by charcoal iron masters.

"3. More excellent for divers reasons, principally being the means whereby the wood and timber of this island, almost exhausted, may be timely preserved yet, and vegetate and grow again into its former wonted cheapness, for the maintenance of navigation, which is the greatest strength of Great Britain, whose defence and offence for all the territories that belong unto it, next under God, and his vicegerent, our Sacred Majesty's cares consist most of shipping, men-of-war, experienced mariners, ordnance, ammunition, and stores; the ordnance made therewith will be more grey and tough, therefore more serviceable at sea and land, and the bar-iron will wall, rivet, and hold better than most commonly chargeable iron. But also in respect this my inventions will preserve many millions of tons of small coal in Great Britain, which will be lost in time to come, and as formerly they were; for within ten miles of Dudley Castle is annually consumed four or five thousand tons, at least, of small pit-coal, and have been so consumed time out of mind, underground, fit to have made pig-iron with, which coals are, and unless iron be made therewith, will be for ever totally and annually lost. If four or five thousands tons of coal be consumed within ten miles of compass, what coal is thus consumed in all England, Scotland, and Wales? which is no good husbandry for Great Britain. *Hinc illæ lacrymæ*, that our timber is exhausted. Must I still be opposed, and never ensured my invention, nor Great Britain the benefit? Must my patent be obstructed in peace, as it was extinct by the wars? And must not my patent be revived for the making of iron with pit-coal, sea-coal, peat, and turf, but find enemies still to oppose it? How many thousand tons of iron might have been made, but since my first invention it is saved one-eighth by my means with pit-coal, and sea-coal lost it, if I had not had enemies, and had not wood and timber been preserved. But most men will aver that it doth concern the author to demonstrate the great loss mentioned formerly of pit-coal annually; it is thus:—'There is at least within ten miles of the Castle of Dudley twelve or fourteen coal works, some in Worcestershire, and some of them in Staffordshire,

now in work; and twice as many in that circuit not in work; each of which works get two thousand tons of coal yearly—some get three, four, or five thousand tons of coal yearly, and the uppermost or top measures of coals are ten, eleven, and twelve yards thick, the coals ascending (basseting was the colliers' term), it cropping up even unto the superficies of the earth, and there the colliers formerly got the coals; but where the coals are deep, and but little earth upon the measure of coals, there the colliers rid off the earth, and dig the coals under their feet; these works are called footrids, but of these works there are now but few. Some of these small coals in these open works the poor people did carry away, but paid nothing for them in former times, termed the brain-carriages, but now the colliers working more in the deep of these works, they are constrained to sink pits, some of which pits are from eight unto twenty yards deep, and some are near twenty fathoms deep, which fathom contains two yards in these pits. After you have made or hit the uppermost measure of coals, and sunk or digged through them, the colliers getting the outermost parts of the coals first about two yards in height or more, and when they have wrought the cruts or stauls (as some colliers call them), as broad and as far in under the ground as they think fit, they throw the small coals, fit to make iron, out of their way on heaps, to raise them up so high to stand upon, that they may, with the working of their picks or maundrills over their heads, and at the one end of the coals, so far in as their tools will admit, and so high as their working cometh unto a parting in the measure of coals, the which coal, to the parting by his self-clogging and ponderous weight, often falls many tons of coals, many yards high, down at once; with which fall, and the colliers breaking of the said coal, many small coals do so abound of no use, and unfit for sale, that in getting of 20,000 tons of pit-coal, one-half is small coal not drawn out of the pits, but destroyed, left, and lost; which small coal, with the thrown moyest together heats the sooner, and by means of its sulphureous fire in the pits, to no small preju-

dice unto the owners of the works, and the workmen, besides Great Britain's loss, which coal might have made many thousand tons of iron, and also have preserved this island's woods and timber.—I might here give you the names, and partly the nature of every measure parting of each coal lying one upon each other. The three uppermost measures are called the *white* measure, for *his* white arsenical, *satsuquorious*, and sulphureous substance, which is in that coal; the next measure is the *shoulder* coal, the *toe* coal, the *foot* coal, the *yard* coal, the *slipper* coal, the *sawyer* coal, and the *fristy* coal; these last three coals are the best for the making of iron, yet other coals may be made use of.

"I might give you other names of coals, but desire not prolixity, yet must I tell you of a supernumerary number of smiths within ten miles of these coal works, near twenty thousand. Yet God of his infinite goodness—if we will but take notice of his goodness unto this nation—hath made this country a very cranati, for the supplying these men with iron, coal, and lime, made with coal, which hath much supplied the men with corn also of late; and from these men a great part not only of this island, but also of his majesty's other kingdoms and territories, with iron wares, have their supply; and wood in these parts almost exhausted, although it were of late a mighty woodland country. Now, if the coals and ironstone so abounding were made right use of, we need not want iron as we do, for very many measures of ironstone are placed together under the great ten yards thickness of coal, and upon another thickness of coal two yards thick, not yet mentioned, called the bottom coal or heathern coal, as if God had decreed the time when and how these smiths should be supplied, and this island also, with iron; and most especially that this coal and iron-stone should give the first and last occasion for the invention of making iron with pit-coal, no place being so fit for the invention to be perfected in as this country for the general good; whose lands did formerly abound in forests, chases, parks, and woods, but exhausted in these parts."

Now for the names of the iron-stone:—"The first measure is called the black-row-graines, lying in very hard and black earth; the second measure is the dun-row-graines, lying in dun earth or clay; the third measure is called the white-row-graines, lying in very white earth or clay; under these three measures are sundry other measures, and are called—first, the rider-stone; secondly, the cloud-stone; thirdly, the bottom-stone; fourthly, the cannock or cannot-stone—which last may well be so called, although all the other measures be very good, yet this stone is so sulphureous and terrestrial, not fit to make iron, because the iron thereof made is very redshare—which is, that if a workman should draw or forge out a share-mould fit for a plough in that red heat it would crack, and not be fit for the use of the husbandman's plough or share.

"I may take occasion here to speak of the nature of coldshare-iron, which is so brittle if made of the grain ore, or ironstone, would be almost as brittle as some *regulus antimonii*, made with iron, for with one small blow over an anvil you may break the biggest bar that is, if it be perfect coldshare iron—nay, the ploughman often breaks his share-point off, if it be made of coldshare-iron; but perfect tough malleable iron will not break feasibly in hot heat or cold, as coldshare will, or red hot as sulphureous redshare-iron will, but yet tough enough when it is cold; all which aforesaid qualities of iron the author very well knoweth how to mend their natures, by fining or setting the finery less transhaw more burrow, which are terms of art, and by altering and pitching the works and plates, the fore-spirit plate, the tuiron bottom, back and breast or fore plate, by the altering of which much may be done, if the work be set transhaw and transiring from the blast; the iron is more coldshare, less fined, more to the master's profit, less profitable to him that makes it into manufactorage, and less profitable to him that useth it, but the iron made in a burrow work becometh more tough and serviceable, yet the nature of all ironstone is to be considered both in the furnace and in the finery; the sulphureous, arse-

nical, and veneriating qualities, which are oftentimes in iron-stone, to be made to separate in both the works from the fixed and fixing bodies of iron, whose fiery quality is such that he will sooner self-calcine than separate from any sulphureous veneriated quality.

"No man, I hope, need to be offended at any terms of art; it hath been always lawful for authors of new arts and inventions, at their own pleasure, to give name to their new inventions and arts; every tradesman is allowed it in his mystery; but the author hath, as much as he could, avoided the terms of art that Simon Sturtevant and others have used, which are very many, only the author hath given you the common names and terms for the most part, which are so common among forgemen and founders, as is nothing more common, but keep secrets amongst them, and a mystery not yet known but unto very few owners of iron works; nay, I have not yet troubled your memory with any of the founders' terms, of but making his hearth—as the timpe-stones, the windwall-stone, the tuiron-stone, the bottom-stone, the back-stones, and the boshes, in the making and picking of which hearth is much of the mystery.

"I must confess there is given unto some philosophers and *filii artis* some few terms, how the sulphureous, arsenical, bituminous, antimonial, and other poisonous qualities, either in the pit-coal, sea-coal, or the iron-stone, may be in part at the furnace separated, and not permitted to be incorporated, yet by fining at the forge to pitch it out; also to melt, extract, refine, and reduce all mines, metals, and minerals, unto their species with pit-coal, sea-coal, peat, and turf, by ways not yet in use, which the author will make known hereafter, if God permit him health, time, and space, or leave his knowledge unto his brother, Aylmore Folliatt, Esq., his nephew, Parkhouse, Esq., and to his kinsman, Master Francis Dingby, to declare unto this latter age of the world in which God is pleased to manifest many of his secrets: *Qui vult secreta scire, secreta secrete sciat custodire.*

"Having suffered much ever since the year 1618 unto this

present for the general good, as by the preceding discourse appears, for the making of iron with pit-coal, sea-coal, peat, and turf, for the preservation of wood and timber of Great Britain, which is much exhausted, for the future prevention of which is—1st, to permit the author to enjoy his patent, and fully to perfect his said intentions, obstructed in the reign both of King James and in the reign of his sacred majesty King Charles the First, of ever-blessed memory, and lately since his most sacred majesty's happy restoration, who desires nothing but to be animated with the patent revived, according unto the statute of 21 Jacobi for inventions; 2d, to empower the author, or any other agents, to take care that no pit-coal or sea-coal be anyways wilfully destroyed underground; 3rd, to put all former good laws in execution, and to make others for the preservation of wood and timber of these nations, especially near navigable rivers or seas; 4th, seeing there goeth out of England, Scotland, and Wales, many thousand tons annually of pit-coal and sea-coal to furnish France, and also the smiths thereof, Spain, Portugal, and Flanders, and especially the smiths thereof, the Low Countries, and the smiths thereof—besides, the Hollanders carry great quantities of our coals unto foreign parts, without which those countries cannot subsist. Now the author's design is, that where there is a conveniency of ironstone or ore, the coals may not be transported (paying his sacred Majesty's duty) until order from his Majesty, or his privy council; 5th, that no pit-coal be exported, seeing that wood fuel, and timber is decayed for building, and instead thereof brick-making (formerly spending wood, but now coals) is much in use. Also is glass now made with coals, but formerly there were many thousand loads of wood fuel spent in the making thereof, and the glass invention with pit-coal was first effected near the author's dwelling; 6th, making of malt brewings, making of copperas, alum, salt, casting of brass and copper, dyeings, and many other works, were not many years since done altogether with the fuel of wood and charcoal—instead whereof, pit-coal and sea-coal is now used

as effectually, and to a better use and purpose, besides the preservation of wood and timber; 7th, that which is somewhat nearer the mark and invention, the blacksmith forged all his iron with charcoal, and in some places where it is cheap they continue this course still, but small pit-coal and sea-coal, and also peat and turf, hath and doth serve the turn as well and sufficiently as charcoal; 8th, that which is nearest to, and my perfect invention, and near the author's dwelling called Green's-lodge, there are four forges, namely—Green's forge, Swin forge, Heath forge, and Cradley forge, which four forges have barred all or most part of their iron with pit-coal, ever since the author's first invention in 1618, which hath preserved much wood in these four; besides many other forges do the like, yet the author hath had no benefit thereby to this present. Yet, by this barring of iron with pit-coal, 30,000 loads of wood and more have been preserved for the general good, which otherwise would have been consumed."

Simon Sturtevant, in his "Metallica," in the epistle to the reader, saith, that there was then, *anno* 12 Jacobi, in England, Scotland, Ireland, and Wales, 800 furnaces, forges, or iron mills, making iron with charcoal. Now we may suppose at least 300 to be furnaces, and each furnace making fifteen tons per week of pig or cast-iron, and work or blow but forty weeks per annum—but some furnaces make twenty tons of pig-iron per week, and two loads of charcoal or thereabouts go to the making of a ton of pig-iron, and two loads (or two cords) of wood at the least go to the making of a load of charcoal. Now what loads of wood or charcoal are spent in Great Britain and Ireland annually, but in one furnace, that makes fifteen tons per week of pig-iron for forty weks, I shall give you the table, and leave you to judge of the rest of the furnaces:—

15 tons per week, spends of charcoal ..	30 loads	Wood ..	60 loads.
Per annum, 40 weeks, spend charcoal ..	1200 ,,	Wood ..	2400 ,,

Also, for one forge that makes three tons of bar-iron, weekly, for fifty weeks; but some forges make double my

proportion, and spend to fine and bar out each ton, three loads of charcoal to each ton.

3 tuns per week	....Charcoal.... 9 loads	Wood.... 18 loads.
per annum	..Charcoal....450 ,,	Wood....900 ,,

It does not, however, appear that Dudley succeeded in his application, and the only further attempt which was made about this time is mentioned by Dr. Plot, in his "History of Staffordshire," he says—"The last effort that was made in this country for making iron with pit-coal, was with raw coal, by a Mr. Blewstone, a German, who built his furnace at Wednesbury, so ingeniously contrived (that only the flame of the coal should come to the ore, with several other conveniences), that many were of opinion he would succeed in it. But experience, that great baffler of speculation, showed it could not be; the sulphureous vitriolic steams that issue from the pyrites, which frequently, if not always, accompanies pit-coal, ascending with the flame, and poisoning the ore, sufficiently to make it render much worse iron than that made with charcoal, though not, perhaps, so much worse, as the body of coal itself would possibly do."

This last experiment is expressly stated to have been made with "raw coal," but it does not appear that this arose from any want of knowledge of the method of coking the coal, as Dr. Plot further mentions:—

"They have a way of charring the coal, in all particulars the same as they do wood—whence the coal is freed from those noxious steams that would otherwise give the malt an ill odour. The coal thus prepared they call cokes, which conceives as strong a heat almost as charcoal itself, and is as fit for most other uses, *but for melting, fining, and refining of iron*, which it cannot be brought to do, though attempted by the most skilful and curious artists."

The various attempts to substitute pit-coal for charcoal having thus failed, no further experiments were made till the early part of the next century, when pit-coal was first used by Mr. Abraham Darby, in his furnace at Colebrook Dale, in 1713; and in the forty-fourth volume of the "Philosophical

Transactions," published in the year 1747, it is stated, that "Mr. Ford, from iron ore and coal, both got in the same Dale (Colebrook), makes iron brittle or tough, as he pleases; there being cannon thus cast so soft, as to bear turning like wrought iron."

At this eventful era in the history of the manufacture of iron, when agriculture was progressively sweeping before it what remained of the once immense tracts of woodland, till then dedicated to the supply of the blast-furnace—when the increased application of machinery, and the introduction of the steam engine, gave hope of new life and impulse to manufactures in general, the iron trade seemed dwindling into insignificance and contempt.

It was not until impelled by necessity that pit-coal again became an object of general consideration, nor until improvements in machinery had attained a great degree of certainty, and experience had taught the mechanic the manifest advantages of the steam-engine — that the adventurous manufacturer found that he possessed in the immense beds of coal an extent of means to which he had till then been a stranger. Small furnaces, supplied with air from leathern bellows, worked by oxen, horses, or human labour, were laid aside, and an increase of size took place, together with an increase of the column of blast necessary to produce combustion. But, notwithstanding the efforts that were then made, there was a gradual, but steady, diminution in the quantity of iron produced, although every year witnessed an increased demand for the article, particularly in its manufactured state.

Recourse was had to foreign markets for the necessary supply, and the immense annual importations from Russia and Sweden may date their origin from this period. The flourishing and extensive detail of Dudley no longer existed, and the 300 blast-furnaces, mentioned by him, were now diminished to fifty-nine, and their total annual produce to 17,350 tons, or not quite 300 tons from each furnace, which is further shown in the following table, distinguishing the

number of furnaces, and the make in each county, in the year 1740:—

	No of Furnaces.	Tons.		No. of Furnaces.	Tons.
Brecon	2	600	Monmouthshire	2	900
Glamorganshire	2	400	Nottinghamshire ..	1	200
Carmarthenshire....	1	100	Salop	6	2100
Cheshire..........	3	1700	Staffordshire	2	1000
Denbighshire	2	550	Worcestershire	2	700
Derbyshire	4	800	Sussex	10	1400
Gloucestershire	6	2850	Warwickshire	2	700
Herefordshire......	3	1350	Yorkshire	6	1400
Hampshire........	1	200		—	———
Kent	4	400	Total	59	17,350

Annual average for each furnace—294 tons, 1 cwt. 1 qr.

CHAPTER III.

IRELAND.

The history of the iron manufacture in England and Wales having been continued from its commencement to its state of prosperity, and subsequent decline, arising from the destruction of the forests, and, consequently, of the means of supplying the furnaces with the fuel, which at that time was indispensable, it will be desirable, before we enter on the account of more extensive operations, to give a short history of the manufacture in Ireland, and also in the British colonies of America.

To the English who settled in Ireland during and after the reign of Elizabeth, the Irish were indebted for the discovery of the iron mines of that country; the natives, constantly engaged either in quarrels amongst themselves, or with the old English as they were termed—that is, those who settled in Ireland from the time of the first conquest until the beginning of Queen Elizabeth's reign—had neither time nor inclination to attend to such inquiries; and the disorganized state of the country also operated on the settlers.

James the First came to the throne soon after the submission of O'Neil, in 1603, and immediately proceeded by a steady, regular, and well-concerted plan, to civilize the inhabitants, to reconcile them to laws and industry, and to render their subjection durable and useful to the crown of England, and, in the space of nine years, he made greater advances towards the reformation of that kingdom than had been made in the 440 years which had elapsed since the conquest was first attempted.

He abolished many Irish customs which supplied the place

of laws,* and which were calculated to keep that people for ever in a state of barbarism and disorder, and substituted English laws in their place; and having taken all the natives under his protection, and declared them free citizens, proceeded to govern them by a regular administration, military as well as civil, and no authority but that of the king and the law was permitted throughout the kingdom. During the peaceful interval which ensued, the English turned their attention to the mineral resources of the country, and, in a few years, discovered many iron mines in different parts of the kingdom, and, favoured by the extensive forests, carried on a considerable manufacture. Giraldus Cambrensis, who accompanied Henry the Second into Ireland on its first conquest, states that the country was then full of woods on every side, but the English, on gaining possession, cut them down, partly in order to deprive the banditti of their lurking places, and partly to gain the greater scope of profitable lands. Another cause operated, which operates in all countries—the desire to obtain wood for fuel. Forests, however, were still numerous in those parts, especially, over which the English had not acquired a perfect and tranquil power.

After the quelling of the great rebellion in Queen Elizabeth's time,† the forests were still more reduced in extent and number. The same motives which operated with the con-

* By the Brehon law or custom, every crime, however enormous, was punished, not with death, but by a fine or pecuniary mulct, which was levied upon the criminal. Murder itself, as among all the ancient barbarous nations, was atoned for in this manner; and each man, according to his rank, had a different rate or value affixed to him, which, if any one were willing to pay, he needed not fear assassinating his enemy. This rate was called his *eric*. When Sir William Fitzwilliams being Lord Deputy, told Maguire that he was to send a sheriff into Fermannah, which a little before had been made a county, and subjected to the English law, "Your sheriff," said Maguire, "shall be welcome to me, but let me know, beforehand, his eric, or the price of his head, that if my people cut it off I may levy the money upon the county." As for oppression, extortion, and other trespasses, so little were they regarded, that no penalty was affixed to them, and no redress for such offences could ever be obtained.—*Hume.*

† O'Neil, Earl of Tyrone, deserted by his allies (the Spaniards) and troops, submitted almost at the very moment of the queen's death. Thus, Elizabeth lived just long enough to effect the subjugation of Ireland—a measure which had in vain been attempted by her predecessors.

querors on their first invasion operated afterwards. Besides, the prospect of gain by the sale of the timber was a further inducement, and immense quantities were shipped to foreign parts.

There were still, however, very extensive forests. In Leinster, the counties of Wicklow, and King and Queen's counties, were throughout full of woods, some many miles long and broad; also many parts of the counties of Wexford and Carlow. In Ulster, there were great forests in the county of Donegal, and in the north part of Tyrone, likewise in Fermanagh, along Lake Erne, in Antrim, and in the north part of Down; the greatest part of this latter county, however, as well as Armagh, Monaghan, and Cavan, were a good deal destroyed. In Munster, the counties of Kerry and Tipperary possessed sundry great forests.

The iron mines are divided by Gerard Boate, in his "Natural History of Ireland," into three descriptions:—1st, what he styles the bog mine, or, what is now termed, lowland ore, found in moors and bogs; the ore resembling a yellow clay, but, after long exposure to the air, mouldering into a blackish sand.—2d, The rock mine; a bad sort, the ore intimately combined with stone. "This mine or ore is not altogether so rich as the bog mine, and yieldeth very brittle iron, hardly fit for anything else but to make plough-shares (from whence the name of 'colt-share' iron is given unto it), and therefore it is seldom melted alone, but mixed with a portion of the bog ore." Of this ironstone only two mines were discovered—the one in Munster, near the town of Tallow, where the Earl of Cork established his iron works; and the other in Leinster, in King's county, in a place called Desart, land belonging to Sergeant-Major Piggot—this iron mine was very extensive, and supplied many iron works which were established in its immediate neighbourhood. The third sort he calls by different names—the fire mine, white mine, and shell mine. "The iron made from this ore is not brittle, as that of the rock mine, but tough, and, in many places, as good as any Spanish iron."

This mine was found in several parts of the kingdom—in

Ulster, in the county of Fermanagh, upon Lough Erne; in the county of Cavan, in a place called Doubally; and in the county of Nether-Tyrone, by the side of the rivulet Lithaw, not far from Lough Neagh, at the foot of the mountains Sluvgalen; in Leinster, in King's county, near Mountmellick; and in Queen's county, two miles from Limerick; in the county of Roscommon, by the side of Lough Allen; and in the county of Leitrim, on the east side of the same lake, where the mountains are so full of this metal that the Irish have given them the name of "Slew-Neren"—mountains of iron; in the province of Munster also these mines were found in various places. These mines having been discovered, the English commenced opening them, and erecting irŏn works in many parts of the country. The most extensive works were those of the Earl of Cork, in Munster; of Sir Charles Coote, in the counties of Roscommon and Leitrim, in Connaught; and in Leinster, by Montrath, in Queen's county; of the Earl of Londonderry, at Ballonakill, in the same county; the Lord Chancellor (Sir Adam Loftus*), and Viscount Ely, at Mountmellick, in King's county; Sir John Dunbar, in Fermanagh, in Ulster; and another in the same county, by the side of Lough Erne, by Sir Leonard Blenerhasset; in the county of Thomond, by some London merchants; besides some other works in other places, whose first erectors we have not been able to ascertain.

In imitation of these there were also many iron works erected in different parts of the sea-coast of Ulster and Munster, by persons who, having no mines in or near their own lands, purchased the ore in England,† which they found

* One of the charges brought against the Earl of Strafford on his trial was his extraordinary proceeding against the Lord Chancellor Loftus:—"The endeavour was, to compel the Lord Chancellor to settle more of his land, and in another manner, upon his oldest son, than he had a mind to, and than he could legally be compelled to; this the Earl (Strafford) upon a paper petition preferred to him by the wife of that son (a lady for whom the Earl had so great a value and esteem that it made his justice the more suspected), pressed, and in the end ordered him to do. The Chancellor refused, was committed to prison, and, shortly after, the Great Seal taken from him, which he had kept with great reputation of ability for the space of above twenty years."—*Clarendon's History of the Rebellion.*

† Three miles to the west of Ulverston, is Whitrich (the Peru of Furness), iron

cheaper than if they had caused the mine to be brought over land from mines in the interior.

The works we have here noticed were all of them bar-iron works, but there were some foundries where they cast ordnance, pots, small round furnaces, and other cast iron wares; the only work which is expressly mentioned is that of Christopher Windesford, Esq., Master of the Rolls in Ireland. Upon the Earl of Strafford quitting that kingdom, he was appointed Lord Deputy*—he had an extensive iron foundry on his lands by Idough, in the county of Carlow.

The materials which we possess to found a history of the extent of the manufacture at this period are extremely meagre; but that it must have been very considerable we ascertain from Boate, who observes—

"The Earl of Cork, whose iron mines being seated in Munster, afforded unto him very good opportunity of sending his iron out of the land by shipping, did in this particular surpass all others, so as he hath gained great treasures thereby; and knowing persons who have had a particular insight into his affairs, do assure me that he hath profited above one hundred thousand pounds clear gain by his said iron works."

He then enters into a more particular description of the works of Sir Charles Coote,† which appear, from the following account, to have been very extensive :—

"Nevertheless, few of them gained more or as much as Sir Charles Coote, because they had not the same conve-

ore is found there at the depth of from twenty to thirty yards; it is raised at 3s. 6d. and 4s. per ton, and pays 1s. 6d. per ton to the lord of the soil. It is carted and put on board vessels for exportation at 3s., and sells from 11s. to 12s. per ton.—*West's Antiquities of Furness.*

* 3d of April, 1630.

† On the breaking out of the rebellion, in 1641, Sir Charles Coote was appointed Governor of the city of Dublin.—"Pursuing the rebels at Trim (1642), he was unfortunately shot in the body, as it was thought, by one of his own troopers, whether by design or accident was never known; it being, for many months after his death, generally reported, and as generally believed, that he was accidentally slain by one of the flying rebels, who, in despair, turned about and discharged his musket at him. And this end had this gallant gentleman, who began to be so terrible to the enemy as his very name was formidable to them. His body was brought to Dublin, and there interred with great solemnity—floods of English tears accompanying him to the grave."—*History of the Irish Rebellion.*

niency of transportation; and he himself did not gain so much by his iron works in Connaught as by that at Mountrath, although the mines there afforded a richer ore, and that the ton thereof did cost him but three shillings at the furnace, because that Lough Allen, whereunto the same mines and works are contiguous, gave him the opportunity of carrying the ore by water from the mine unto the works, and that in boats of forty tons. At that work (Mountrath, in Queen's county) the ton of rock mine at the furnace head came in all to stand in five shillings and sixpence sterling, and the ton of white mine, which he had brought from a place two miles further off, in seven shillings; these two were mixed in that proportion, that to one part of rock mine were taken two parts of white mine, for if more of the rock mine had been taken, the iron would not have been so good, and too brittle; and being thus mixed, they yielded one-third part of iron—that is to say, of two tons of white mine, and one of rock mine, being mingled and melted together, they had one ton of good iron,* such as is called merchant iron, being not of the first, but second melting, and hammered out into bars, and, consequently, fit for all kinds of use.

"This iron he sent down the river Nore, to Ross and Waterford, in that kind of Irish boats which are called cots in that country, being made of one piece of timber; which kind of ill-favoured boats are very common throughout all Ireland, both for to pass rivers in, and to carry goods from one place to another, and not only upon shallow waters, such as the aforenamed river is, in the greatest part of its course, but even upon the great rivers and loughs.

"At Waterford the iron was put on board ships going to London, where it was sold for sixteen, otherwhiles for seventeen pounds, sterling, and sometimes for seventeen and a

* In most of the other places did a ton of the iron mine or ore come to stand in 5s., 5s. 6d., and 6s. sterling at the furnace head; and it was an ordinary thing, as well where they used white mine as where they mixed rock mine with it, to have a ton of good iron out of three tons of ore; in some places where the ore was richer they could have a ton of iron out of only two tons and a half of ore.—*G. Boate's Nat. Hist. of Ireland.*

half; whereas, it did not stand Sir Charles Coote in more than betwixt ten and eleven pounds sterling, all charges reckoned, as well of digging, melting, fining, as of carrying, boat hire, and freight, even the custom also comprehended in it.

"It is to observed, that although there be wood enough upon one's land, and that not very far from the mine, together with the conveniences of water-courses, so as the water needeth not to be brought from very far off, nevertheless the charge is very great, both of erecting and stocking one of the iron works, and of maintaining it and keeping it a-foot, and that by reason of the great number of workmen and labourers of several sorts which thereunto is requisite—a list of whose names and offices here followeth:—

"Woodcutters—who fell the timber.

"Sawyers—to saw the timber.

"Carpenters, smiths, masons, and bellows-makers—to erect the iron works, with all the appurtenances, and to repair them from time to time.

"Water-leaders, or water-course keepers—to steer the water-courses, and to look to them constantly.

"Basket-makers—to make baskets to carry the ore and other materials.

"Boatmen and boatwrights—to make the boats, and to go in them.

"Diggers—who work in the mine, and dig the same.

"Carriers—who carry the ore from the mine.

"Colliers—who make the charcoal.

"Corders—who bring the charcoal to the work.

"Fillers—whose work it is from time to time to put the mine and the coals into the furnace.

"Keepers of the furnace—who look to the main work, rake out the ashes and cinders, and let out the molten metal, at convenient times.

"Finers—who look to the works where the iron is hammered.

"Hammerers—whose work is to see the iron hammered out.

"Besides several other labourers, who, having no particular task, must help to put their hands to every thing.

"Of all which sorts of men, Sir Charles Coote, the elder, that zealous and famous warrior in this present war against the Irish rebels (wherein having done many memorable exploits, he lost his life in the first year thereof), did continually keep at work some five-and-twenty, or six-and-twenty hundred, at his iron works, being three in number, whereby may easily be gathered the greatness of the expenses in erecting and maintaining of iron works; and for all this the owners thereof did greatly gain thereby, ordinarily no less than forty in the hundred per annum."

In the general destruction of property, belonging to the English, almost the whole of the iron-works were destroyed by the rebels; in the neighbourhood of Lough Conn, in the county of Mayo, there were some valuable iron works remaining, and these were continued as long as they could obtain a supply of fuel.

At a later period, about 1660, Sir William Petty* erected extensive iron-works, near the village of Blackstones, in the county of Kerry; these works were carried on till towards the middle of the last century, when, having exhausted all the timber in the neighbourhood, they were obliged to stop the works. It seems a little surprising that Sir William Petty should not have taken more care to preserve his woods, by copsing them up as they were cut down, as the practice is in Sweden, and other countries where there are iron-works, by which means a continual succession of underwood is obtained, but as these woods grow upon the best and driest soils, the persons who first cut them down, found the ground, thus cleared of trees, to be the most suitable places for pasture, and therefore neglected to keep them up.

Sir William Petty, in his political anatomy of Ireland, remarks that in 1672 there were 1000 tons of iron made in Ireland, which gave employment to 2000 men and women;

* At the Restoration, Mr. Petty was treated with great attention by the King, and knighted, and created Surveyor-General of Ireland. His son was created Lord Shelburne by King William.—*Lemp. Biog. Dict.*

and that there were 6600 smiths' forges, or rather, as he thinks, one-fifth more, and that the men and women employed therein amounted to 22,500.

By an Act passed in England, in the eighth year of William the Third, the duties on bar-iron, and iron slit and hammered into rods, imported from Ireland were taken off, in consequence of the then depressed condition of manufacturing industry in Ireland. This removal of duty naturally occasioned a great demand for Irish timber, which, moreover, was constantly imported into England at the value, as stated in the Book of Rates, of 13*s.* 4*d.* the ton, and, consequently, liable to scarcely any duty. The unsettled state, besides, in which Ireland had long been, and the refuge which its forests afforded to criminals, outlaws, and those who were hostile to the existing government, rendered the landlords careless with regard to the preservation of their woods, or rather, it should seem, averse to their existence, for in many old leases, clauses are to be found requiring the tenants to use no other article for fuel but timber.

From these causes, a scarcity was soon experienced, to such a degree, as to lead the parliament of Ireland, in order to put a stop to this improvident waste, to pass an Act* for planting and preserving timber trees and woods, of which the preamble runs thus:—"Forasmuch as by the late rebellion in this kingdom, and the several iron works formerly here, the timber was utterly destroyed," &c.

This Act required that 260,600 trees should be planted in Ireland, proportionably in the several counties, and laid heavy penalties on such persons as neglected to comply with the requisition. It also required proprietors and tenants to plant a certain number annually, and the persons, or societies, who had iron works, to plant 500 in each year, during the continuance of their works. But the number of trees was inconsiderable, and no effect of an extensive and permanent nature appears to have been produced. The Act too was defective, inasmuch as it did not provide against the waste of such few woods as still remained.

* 10th William III. c. 12.

Besides, the consumption of home-made iron and Irish timber was left unchecked by the importation of foreign iron and timber, as heavy duties on these continued until 1703, when they were reduced to 5*s*. custom and 5*s*. excise per ton on iron, 6*d*. custom and 6*d*. excise per 1000 staves, 1*d*. per 1000 on hoops and laths, and 1*d*. per barrel on bark. The same Act, 2 Anne, c. 2, laid a duty of 2*l*. 10*s*. on every ton of timber and plank, 5*s*. on every 1000 hoops or laths, and 3*l*. on every 1000 staves exported from Ireland, except to England—an exception which was calculated to render the Act in a great degree nugatory. Moreover, by the 4th Anne, c. 9, the penalties incurred by non-compliance with the requisitions in the 10th William III. c. 12, were remitted to such as had not paid them, and further time was given to avoid them—in other words, the latter statute was virtually repealed. It was finally so by the 8th George I. c. 8, which acknowledged that the Act in question had proved ineffectual.

The manufacture of iron was thus lost to Ireland, and, with a single exception, no attempt has been made to revive it. A furnace was erected about fifty or sixty years since by a family of the name of O'Reilly, and was worked by them, and also since, on two or three occasions. An English company, called the Arigna Company, took this property, and added a new furnace: no works, however, are at present going on.

CHAPTER IV.

BRITISH COLONIES IN AMERICA.

It was in the year 1516 that the British first took a share in American trade. Sir Walter Raleigh's discovery of Virginia, in 1584, and his attempts to colonise the English failed; but in the reign of James the First better regulations were made, and colonisation was successful for a time: in succeeding reigns it arrived at importance. We soon perceive the gradual increase of British dominion, and the colonies rising into consequence, and, by victory over the French, increasing, until the unhappy war with the mother country, which ended in the union of the States, and their establishment in independence.

Iron was first made in America in the province of Virginia, about the year 1715, and the example was quickly followed by the provinces of Maryland and Pennsylvania. This opening of a new source of wealth was a subject of great satisfaction and importance to those who were interested in the prosperity of the colonies, presenting to their view, at no distant date, a prospect of independence of foreign countries for the supplies of those most essential articles, iron and timber. That it was considered in this light is shown by a writer of that day, who observes—

"That the waste and destruction of the woods in the counties of Warwick, Stafford, Worcester, Hereford, Monmouth, Gloucester, and Salop, by their iron-works, is not to be imagined, and that if some care be not taken to preserve our timber from these consuming furnaces, there will not be oak enough left to supply the royal navy and our mercantile shipping. That, within these sixty years, Ireland was better

stocked with oak timber than we now are; but the iron-works since set up there have, in a few years, swept away the wood to that degree, that they have not small stuff enough to produce bark for their tanning, nor timber for common uses, insomuch, that at present they are forced to have bark from England, and building timber from Norway, and to suffer their large hides to be exported untanned to Holland, Germany, and other countries. That about 20,000 tons of iron are annually imported into England from foreign parts, over and above what is made at home, for which we pay ready money, which, at 12*l.* per ton, comes to 240,000*l.*, paid annually to foreigners; and the boards and other timber which we take of them come to 200,000*l.* more; whereas, our own plantations would be paid for their iron and timber in our own manufactures, thereby evidently bringing a double benefit to the nation. That they have ironstone all along the continent, from the southernmost part of Carolina to the northernmost part of New England, in great plenty, and no part of the world abounds more with prodigious quantities of wood, nor with more rivers and streams. That the Swedes have laid near 25 per cent, additional duty on their iron, and that the interruptions of our trade in the Baltic had greatly distressed our iron manufactures for want of iron. That, by the naval store laws now in force, which comprehend only pitch, tar, and turpentine, such great quantities thereof are produced and imported from our plantations as enable us to export great quantities thereof to the Straits, Spain, Portugal, Holland, Bremen, and Hamburgh. That, taking timber and iron, as well as flax and hemp, from our plantations, would employ a vast many ships and people. That iron, in particular, is a commodity of universal use, and certain in all parts of the world, and therefore as much to be valued as gold or silver. That the Dutch supply Portugal, the Straits, and Turkey, with great quantities of iron, and had we a full supply of it from our plantations, we might not only ballast our ships with it, but export great quantities to those countries, and even to Africa and India." But the proprietors of our own works took a very different view of the matter, to

them it was a cause of great jealousy and uneasiness, and they used every exertion to render inoperative the legislative enactments which were intended for the encouragement of the manufacture.

In 1719 a bill was brought into Parliament with the object of rendering the laws concerning the importation of naval stores from the British American plantations more comprehensive, by admitting from them all sorts of timber:—

"For whereas in our trade thither, it sometimes happens that the crops of tobacco, sugar, &c., fall short, many ships in that case are obliged to come home to Great Britain bad freighted, and some remain there a whole season, waiting for the next crop."

It was therefore imagined by the House of Commons, that if encouragement were given for bringing timber from our plantations, full freight would be secured for our ships, and the demand from our northern colonies, for British manufactures of all kinds, would be greatly increased, and their people diverted from further attempts to become themselves the manufacturers of such productions as could be much more advantageously furnished to them by Great Britain and Ireland. But the colonies were so surprised and disappointed by some clauses in the bill, that rather than submit to them they preferred to forego entirely the benefits it would have conferred upon them, and they were very glad to have it dropped altogether. Such for instance, "that none of the plantations should manufacture iron wares of any kinds, out of any sows, pigs, or bars, whatsoever, under certain penalties." By which clause no smith in the plantations might make as much as a bolt, spike, or nail, whereby the colonies must have been brought into a miserable condition, the smith being, above all other trades, absolutely necessary in all employments there; amongst the rest, that of shipbuilding would have been utterly destroyed, although thereby they made a great part of their returns for the British manufactures. The House of Peers added another clause—"That no forge going by water, or other work whatsoever, should be erected in any of the plantations, for

making sows, pigs, or cast iron, into bar or rod iron." This second clause must have ruined all the iron works in the colonies to the great loss of their proprietors, and have given the French a fair handle to tempt them into their settlements.

Much was said in pamphlets and newspapers in the year 1737 in favour of the importation of iron and hemp from the British American colonies, as being two articles of the first importance for our navy and mercantile shipping, as well as for numberless other services, and petitions were presented to Parliament for this end by the merchants.

1st. It was computed that England imported annually about 20,000 tons of foreign iron, whereof 15,000 tons were from Sweden, which cost about 150,000*l.*, and was mostly paid for by us in money, as was most of the other 5000 tons brought from Russia, and that our exports of wrought-iron were from 3000 to 3500 tons per annum.

2d. That the iron of the British colonies is as good as any foreign iron whatever, and, with proper encouragement, might be imported in quantities sufficient to supply all the iron we get from the two nations, on whom we are at present dependent for that commodity, without their taking sufficient of our product and manufactures in return; whereas, our own colonies would be entirely paid by our manufactures, the demand for which would thereby be much increased, and 180,000*l.* per annum would be clearly saved to the nation in the balance of our trade. It was, moreover, computed that England makes annually about 18,000 tons of bar-iron; the quantity of which, it was said, we could not increase, by reason of our woods being so far exhausted as to have greatly enhanced the price of cord wood used in the refining of iron-stone; and were we to import more pig-iron from America, and make less of it at home, we should be able, with the same quantity of wood we now consume, to make much more bar-iron at home.

3rd. That nothing is more likely to prevent our American colonies from falling into such manufactures, as must interfere with our own, than giving them encouragement to pro-

duce such rough materials as pig, sow, and bar-iron, hemp, &c., as it is well known of what great advantage to this kingdom the bounties on the importation of pitch and tar from thence have been since the year 1703.

4th. That for this end a duty should be laid in our colonies on all iron imported there from Europe.

On the other hand, the great and natural opposers of the merchants' petitions were the proprietors of the English iron works and of the wood lands of England. The promoters of this scheme for encouraging the importation of iron from our American colonies, proposed that an additional duty should be laid on all foreign bar-iron imported, excepting only such as shall be imported from our American colonies, and to repeal the present foreign duty on all bar-iron which may be hereafter imported from our plantations; but so many jarring interests prevented the legislature at that time from passing any new law on the subject.

In the year 1750, an Act, 23d Geo. II., was passed, for encouraging the importation of pig-iron from the British colonies in America. Every well-wisher to his country reflected with concern on the nature of the British trade with Sweden, from which kingdom we imported more iron and steel than all the other countries in Europe. For this article a great balance was paid in ready money, which the Swedes again expended in purchasing from the French and other mercantile states those necessaries and superfluities with which they might have been as cheaply furnished by Great Britain. In the meantime, our colonies were restricted by severe duties from taking advantage of their own produce, in exchanging their iron for such commodities as they were under the necessity of procuring from the mother country. This restriction was not only a grievance upon our own settlements, but also attended with manifest prejudice to the interest of Great Britain, annually drained of great sums, in favour of a nation from whom we derived no advantage in return. Whereas, the iron imported from America must of necessity come in exchange for our own manufactures. The Commons having appointed a

day for taking this affair into consideration, carefully examined into the state of the British commerce carried on with Sweden, as well as into the accounts of iron imported from the plantations of America; and a committee of the whole House having resolved, that the duties on American pig and bar-iron should be repealed, a bill was brought in for that purpose. "That pig-iron, made in the British colonies in America, may be imported duty free, and bar-iron into the port of London; no bar-iron so imported to be carried coastwise, or to be landed at any other port, except for the use of his Majesty's dock-yards; and not to be carried beyond ten miles from London."

The Act, however, contained the following clause:—"That from and after the 24th day of June, 1750, no mill or other engine for slitting or rolling of iron, or any plating forge, to work with a tilt hammer, or any furnace for making steel shall be erected, or, after such erection, continued in any of his Majesty's colonies of America."

And the governors of the colonies were ordered to transmit, for the information of government, an account of all slitting mills, plating forges, and furnaces for making steel—and this return was accordingly made in the ensuing year.* This precaution being taken, that the colonies might not interfere with the manufactures of their mother country. During the progress of this bill, which made its way through both Houses, and obtained the Royal assent, the tanners in and about the town of Sheffield, in Yorkshire, represented, that if the bill should pass, the English iron would be undersold, consequently, a great number of furnaces and forges would be discontinued; in that case, the woods used for fuel would stand uncut, and the tanners be deprived of oak bark sufficient for the continuance and support of their occupation. They, nevertheless, owned, that should the duty be removed from pig-iron only, no such consequence could be apprehended, because, should the number of furnaces be lessened, that of forges would be increased. This was likewise the plea urged in divers remonstrances by masters of iron works, gen-

* See Appendix A.

tlemen, and freeholders, who had tracts of wood-land in their possession. The owners, proprietors, and farmers of furnaces and iron forges, belonging to Sheffield and its neighbourhood, enlarged upon the great expense they had incurred in erecting and supporting iron works, by means of which great numbers of his Majesty's subjects were comfortably supported. They expressed their apprehension that, should the bill pass into a law, it could not in any degree lessen the consumption of Swedish iron, which was used for purposes to which neither the American nor British iron would be suitable; but that the proposed encouragement of the manufacture of iron in America, considering the plenty and cheapness of wood, would enable the colonies to undersell the British iron—a branch of traffic which would be totally destroyed—to the ruin of many thousand labourers, who would be compelled to seek their livelihood in foreign countries. They likewise suggested, that if all the iron manufactures of Great Britain were to depend upon a supply of iron from the plantations, which must ever be rendered precarious by the hazard of the seas and the enemy, the manufactures would probably decay for want of materials, and many thousand families be reduced to want and misery.

On the other hand, the ironmongers and smiths belonging to the flourishing town of Birmingham, in Warwickshire, presented a petition, declaring that the bill would be of great benefit to trade, as it would enable the colonists to make larger returns of their own produce, and encourage them to take a greater quantity of the British manufactures. They affirmed, that all the iron-works in Great Britain did not make half the quantity of the metal sufficient to carry on the manufacture; that, if this deficiency could be supplied from the colonies in America, the importation from Sweden would cease, and considerable sums of money be saved to the nation. They observed, that the importation of iron from America could no more affect the iron-works and freeholders of the kingdom than the like quantity imported from any other country; but they prayed that the people of America might be restrained from erecting

slitting, or rolling mills, or forges for plating iron, as they would interfere with the manufactures of Great Britain.

Many remonstrances to the same effect were presented from different parts of the kingdom, and it appeared, upon the most exact inquiry, that the encouragement of American iron would prove extremely beneficial to the kingdom, as it had been found upon trial applicable to all the uses of Swedish iron, and as good in every respect as the produce of that country.*

Such are the connexions, dependencies, and relations subsisting between the mechanical arts, agriculture, and manufactures of Great Britain, that it requires study, deliberation, and inquiry in the legislature to discern and distinguish the whole scope and consequences of many projects offered for the benefit of the commonwealth. The society of merchant adventurers in the city of Bristol alleged, in a petition to the House of Commons, in the year 1756, that great quantities of bar-iron were imported into Great Britain, from Sweden, Russia, and other parts, chiefly purchased with ready-money, some of which iron was exported again to Africa and other places, and the rest wrought up by the manufacturers. They affirmed that bar-iron, imported from North America, would answer the same purposes, and the importation of it tend not only to the great advantage of the kingdom, by increasing its shipping and navigation, but also to the benefit of the British colonies. That, by an Act passed in the 23rd year of his present Majesty's reign, the importation of bar-iron from America into the port of London, duty free, was permitted. But to carry coastwise, or further by land than ten miles, had been prohibited, so that several very considerable manufacturing towns were deprived of the use of American iron, and the outports prevented from employing it in their export commerce. They requested, therefore, that bar-iron might be imported from North America into Great Britain, duty free, by all his Majesty's subjects. This request being supported by many other petitions from different parts of the kingdom, other classes of men, who thought that their several interests

* See Appendix B.

[illegible] took the alarm, and, in [illegible] many ill consequences which [illegible] being passed into a law. [illegible] sides of the question, and [illegible] subject, which was justly deemed [illegible]

[illegible] observed, that large quantities of [illegible] at home, and employed multitudes [illegible] no less than 109 forges in England [illegible] erected in Scotland, the whole pro- [illegible] iron. That as the mines in Great [illegible] haustible, the produce would of late years [illegible] ably increased, had not the people been [illegible] apprehension of seeing American iron [illegible] free—a supposition which had prevented [illegible] extending their works, and discouraged [illegible] in this branch of traffic. They alleged, [illegible] already carried on in England occasioned [illegible] of 198,000 cords of wood, produced in cop- [illegible] barren lands, which could not otherwise [illegible] good account. That, as the coppices [illegible] preserved a moisture in the ground, the [illegible] valuable with the wood than it would be if [illegible] grubbed up; consequently, all the estates [illegible] grow would sink in their yearly value. That [illegible] cultivated and preserved for the use of [illegible] likewise absolutely necessary for the [illegible] as they furnish bark for the tanners; [illegible] the management of these coppices, [illegible] number of timber trees, necessary for [illegible] They asserted, that neither the [illegible] that had yet been found in Great [illegible] being converted into steel as that [illegible] particularly that sort called ore- [illegible] mines in the northern part of Britain, [illegible] with those of Sweden, furnished [illegible] of wood, and rivers for mills and [illegible] doubted that people would find

metal of the same quality; and in a few years, be able to supersede the necessity of importing iron either from Sweden or Russia. They inferred that American iron could never interfere with that which Great Britain imported from Sweden, because it was not fit for edged tools, anchors, chain plates, and other articles required in ship building; nor diminish the importance of Russian iron, which was not only stronger than the American and British, but also could be afforded cheaper than that brought from our own plantations, even though the duty on this last should be repealed. The importation of American iron, therefore, duty free, could interfere with no other sort but that produced in Britain, with which, by means of this advantage, it would clash so much as to put a stop in a short time to all the iron-works now carried on in the kingdom, and reduce to beggary a great number of families whom they now support.

To these objections the favourers of the bill replied, that when a manufacture is much more valuable than the raw materials, and these cannot be produced at home in sufficient quantities, and at such a price as is consistent with the preservation of the manufacture, it is the duty of the legislature to admit a free importation of these materials, even from foreign countries, although it should put an end to the production of that material in this island. That, as the neighbours of Great Britain are now more attentive than ever to their commercial interests, and are endeavouring to manufacture their rough materials at home, this nation must take every method for lowering the price of materials, otherwise, in a few years, it will lose the manufacture, and instead of supplying other countries, be furnished by them with all the fine toys and utensils made of steel and iron. That, being in danger of losing not only the manufacture, but the produce of iron, unless it can be procured at a cheaper rate than that at which it is sold at present, the only ways of averting this evil are, by diminishing the duty payable upon the importation of foreign iron, or by rendering it necessary for the masters of the iron mines in Great Britain to sell their produce cheaper than it has been for some years afforded. That the

most effectual method for this purpose is, to raise up a rival, by permitting a free importation of all sorts of iron from the American plantations. That American iron can never be sold so cheap as that of Britain, for in the colonies labour of all kinds is much dearer than in England; if a man employ his own slaves he must reckon in his charge a great deal more than the common interest of their purchase-mony, because, when one of them dies, or escapes from his master, he loses both interest and principal. That the common interest of money in any plantations is considerably higher than in England, consequently, no man in that country will employ his money in any branch of trade by which he cannot gain considerably more per cent. than is expected in Great Britain, where the interest is low, and the profit moderate—a circumstance which will always give a great advantage to the British miner, who likewise enjoys an exemption from freight and insurance, which press heavily on the American adventurer, especially in time of war. With respect to the apprehension of the leather tanners, they observed, that, as the coppices generally grow on barren lands, not fit for tillage, and improved the pasturage, no proprietor would be at the expense of grubbing up the wood to spoil the pasture, as he could make no other use of the land on which it was produced. The wood must be always worth something, especially in counties where there is not plenty of coal, and the timber trees would produce considerable advantage; therefore, if there were not one iron mine in Great Britain, no coppice would be grubbed up, unless it grew on a rich soil, which would produce corn instead of cordwood, consequently, the tanners have nothing to fear, especially as planting hath become a prevailing taste among the landholders of this island.

The committee appointed to prepare the bill, seriously weighed and canvassed these arguments, examined disputed facts, and inspected papers and accounts relating to the produce, importation, and manufacture of iron. At length Mr. John Pitt reported to the House their opinion, implying that the liberty granted by an Act passed in the 23d year of his

Majesty's reign, of importing bar-iron from the British colonies in America into the port of London, should be extended to all the other ports of Great Britain, and that so much of that Act as related to this clause should be repealed. The House having agreed to these resolutions, and the bill being brought in accordingly, another petition was presented by several noblemen, gentlemen, freeholders, and other proprietors, owners and possessors of coppices and woodlands, in the West Riding of Yorkshire, alleging that a permission to import American bar-iron, duty free, would be attended with numberless ill consequences, both of a public and of a private nature—specifying certain hardships to which they, in particular, would be exposed—and praying that, if the bill should pass, they might be relieved from the pressure of an Act passed in the reign of Henry VIII., obliging the owners of coppice woods to preserve them under severe penalties, and be permitted to fell and grub up their coppice woods, in order to a more proper cultivation of the soil, without being restrained by the fear of malicious and interested prosecutions.

In consequence of this remonstrance, a clause was added to the bill, repealing so much of the Act of Henry VIII. as prohibited the conversion of coppice or underwood into pasture or tillage. It then passed through both Houses, and received the royal sanction.

As there was not time, after this affair came upon the carpet, to obtain any new accounts from America, and as it was thought necessary to know the quantities of iron made in that country, the House presented an address to his Majesty, desiring he would be pleased to give directions that there should be laid before them, in the next session of Parliament, an account of the quantity of iron imported from the American colonies, from Christmas, in the year 1749, to the 5th day of January, in the year 1756, each year being distinguished.

In 1765 an Act was passed allowing our American colonies to ship their iron for Ireland.

As it began to be seen, that our true interests consisted in giving some protection to the iron foundries in England,

which had arisen by individual interest alone, an Act of Parliament was passsd in 1769 for discontinuing, upon the exportation of iron in foreign ships, the drawbacks of such parts of the duties payable thereon as exceeded the duties payable upon iron imported in British ships. In this year the importation of iron from Russia alone amounted to upwards of 34,000 tons. To such an extent, through the fostering care first given by Peter the Great, had the iron mines arrived in Russia, that they materially injured the sale of the Swedish iron, from whence, much less than a century before, they used to import considerable quantities into Russia. Such are the effects to be produced when governments wisely patronize national objects of improvement and industry.

The American war breaking out in 1775, a formidable rival, as then considered, to our iron trade was removed, and soon after the close of that war the increase of our trade, and the extension of our manufactures, created an additional consumption of iron in the country; and although we had powerful competitors in Russia and Sweden, yet our furnaces, with the agency of the steam-engine, were producing an annual increase, by manufacturing iron with pitcoal instead of charcoal.

CHAPTER V.

GREAT BRITAIN.

Before we proceed to detail the vast results in the iron trade, consequent upon the use of pit-coal, aided by the powerful assistance of the steam-engine, it will be desirable to take a retrospective view of the means hitherto employed for blowing the furnaces.

The machine first employed for this purpose was a pair of leather bellows, worked by the hand; but when it became necessary to smelt iron in large quantities, the size and number of the bellows were increased. Two pairs of bellows were so connected, by means of a lever, that the one pair shut when the other opened. The handle of each pair was successively moved by two cogs, placed at right angles to each other on the horizontal axis of a water-wheel, so that, during the revolution of the wheel, one of the cogs shut one pair of bellows, and forced the included air into the furnace—while the other, which at this instant opened, was shut by the action of the other cog, and thus discharged its contents into the furnace. By this means a continued blast was kept up, excepting a trifling pause when the motion was changed.

Another engine, called the water blowing machine, has been used for producing a strong blast. It has been pretty generally adopted on the Continent, but does not seem to have come into use in this country. A current of water is made to pass through a kind of cullender, placed in the open air, and perforated with a number of triangular holes. The water descends through these apertures in many small streams, and by exposing a great surface to the atmosphere, it drags along with it an immense quantity of air, and is conveyed

through a tube till it dashes against a stone pedestal inclosed in a large vessel. The mixture of air and water which falls upon the pedestal is dispersed in every direction—the air is separated from the water—it ascends to the upper part of the vessel, and rushes through a pipe to the furnace, while the water descends through apertures at the bottom of the vessel.* It is proper to observe, however, that, as by this method the air was loaded with moisture, it was necessary to make the condensing vessel as high as conveniently could be, that the air might arrive at the furnace in as dry a state as possible.

Machines of such a description might have been sufficient for smelting iron, when charcoal was used for fuel; when, from the small quantity of air that was then requisite for blast, whether from the great inflammability of the fuel, or the smallness of its capacity, the manufacturer had more frequently felt the effects of over-blowing than under-blowing his furnace; but now, when coal began to be used, it became necessary to construct machines formed of the most durable materials, and capable of affording a powerful and constant blast.

The earliest contrivance of this kind was a forcing pump, worked by a water-wheel or a steam-engine; and it would appear, that the first cylinders—at least, of any magnitude—were erected at the celebrated Carron Iron Works, in the year 1760, by Mr. John Smeaton, soon after these works (which, in a few years, became amongst the most famous in Europe†) had been established by the projector, Dr. Roebuck, and other parties.

* Franciscus Tertius de Lanis ("Magister Nat. et Artis," lib. 5. chap. iii.) observes, that he has seen a greater wind generated by a machine of this kind than could be produced by bellows ten or twelve feet long.

† The Carron Works consist of five blast furnaces, sixteen air furnaces, a clay mill for grinding clay and making fire bricks for the use of the said furnaces, an engine that raises four tons and a half of water at one stroke, and, on an average, draws seven strokes in a minute. This engine goes in time of drought, and consumes sixteen tons of coal in twenty-four hours. Besides the coals consumed by this engine, there are 120 tons burnt every day in the works, and by the inhabitants belonging to them. Besides the air furnaces there are three cupola furnaces, that go by virtue of the blast furnaces, by pipes conveyed from the machinery of the blasts—their business is much the same with the air furnaces. There are also four boring mills

According to the custom of the times, the operation of blowing was at first performed by large bellows, moved by means of a water-wheel. Pitcoal was the staple fuel in use, it having been very generally applied, since the year 1750, as a substitute for charcoal in the blast furnace, but the scanty supply of air, and its want of density, seldom permitted the produce of the furnace to exceed ten or twelve tons weekly; and frequently, in summer, the quantity was reduced even below this. The Carron Company collected immense quantities of charcoal, and they found that their blast was much better calculated for the operation of smelting with it, than with the uninflammable pit-coal obtained in their neighbourhood. Experience, however, gradually unfolded means of adapting machinery better calculated to the nature of the coal fuel; more powerful wheels were constructed, the bellows were abandoned, and, in their place, large iron cylinders were introduced.

These cylinders were four feet six inches diameter, exactly fitted with a piston, moved up and down by means of a water-wheel. In the bottom of the cylinder is a large valve, like

for boring guns, pipes, cylinders, &c. One of the boring mills is adapted for turning the guns on the outside: they have likewise smiths' forges, for making the largest anchors and anvils, as well as small work of various kinds; besides a forge for making malleable iron, and a plating forge, also a forge for stamping iron, the hammer of which, with the helve, are both of cast metal, and weigh a ton and a half.—*Sir J. Sinclair's Statistical Account of Scotland*—1792.

Nobody is admitted to view the works on Sundays, except those who are properly recommended, or known to be worthy of attention. Mr. Burns, the Ayrshire poet, not knowing, or not attending to, this regulation, made an attempt to be admitted, without discovering who he was, but was refused by the porter. Upon returning to the inn at Carron, he wrote the following lines upon a pane of glass, in a window of the parlour into which he was shown:—

"We cam na here to view your warks
In hopes to be mair wise;
But only, lest we gang to hell,
It may be nae surprise.

"But when we tirl'd at your door,
Your porter dought na bear us;
So may, should we to hell's yetts come,
Your billy, Satan, sair us."

—*Ibid*—1797.

that of a bellows, which rises as the piston is lifted up, and thus admits the air into the cavity of the cylinder below. Immediately above the bottom is a tube which goes to the furnace, and as it proceeds from the cylinder, is furnished with a valve opening outwards. Thus, when the piston is drawn up, the valve in the bottom rises, and admits the air that way into the cylinder, while the lateral valve shuts, and prevents any air from getting into it through the pipe. When the piston is thrust down, the valve in the bottom shuts, while the air being compressed in the cavity of the cylinder, is violently forced out through the lateral tube into the furnace.

There were four of these large cylinders applied to blow the furnace, and so contrived that the strokes of the pistons, being made alternately, produced an almost uninterrupted blast. The pumps being worked alternately by a water-wheel having four cranks upon its axis, each of which moved the piston of a cylinder, which had a stroke of four feet six inches, some little intermission could indeed be perceived, but it was too trifling to produce any sensible effect on the furnace. Even this could have been prevented by means of a large reservoir, into which all the four cylinders might discharge their blast.*

* The situation and singular construction of the Devon Iron Works, begun in July, 1792, merit the attention of the curious in mechanics and architecture. A steep bank rises more than fifty feet above the level of the river, and is composed of a rock, or very thick stratum of freestone, very dry, and uniform in its texture, and almost free from cracks and fissures. Instead of the usual method of building with stone and lime, the several parts of the works have been formed in this bank by excavations made in the rock. Two furnaces, which are each above forty feet high and fourteen feet diameter, and also the spacious arches which give access to the workmen, at the bottom of the furnace, to draw off the liquid metal and slag, are cut out of the rock. The roof which covers the casting-house, a room seventy feet long, fifty feet wide, and twenty-three feet high, is supported by the sides of the quarry and the solid pillars of the rock, that were left for this purpose in making the excavation. In like manner is formed the engine-house and its apparatus, which is intended to supply the two furnaces with wind, by throwing, at each vibration of the engine, a sufficient quantity of air, out of a large cylinder into a long gallery, or close mine, formed in the rock. This magazine of wind will contain above 10,000 cubic feet of air, much condensed by the power of the engine, as the gallery is very closely shut

A larger column of air, of triple or quadruple density, was thus obtained, and effects equivalent to these great improvements followed. The same furnace, that formerly yielded ten and twelve tons weekly, now, sometimes, produced forty tons in the same period, and, on the average, in one year, 1500 tons of metal.

In situations where a fall of water could not be obtained, steam-engines were employed to work the pumps; but as these machines were then only single, the piston descending by the pressure of the atmosphere, it was necessary to have some contrivance for producing a continued stream of air during the descent of the piston. This object was effected by receiving the air into a regulating cylinder, of the same size as the blowing cylinder, and furnished with a piston loaded with heavy weights. As every stroke of the engine would pump into this cylinder twice the quantity of air that would pass through the nose pipe into the furnace in the same time, the air raised the loaded piston of the regulating cylinder, and during the time that the engine ceased to act, the weight of the regulating piston forced the air into the furnace. This method of regulating the blast, which continued in general use for many years, was superseded by the water regulator, and by the double-acting blowing cylinder, wrought by a steam-engine of Watt and Boulton's construction.

The iron trade began immediately to revive on the application of pit-coal, aided by powerful engines, and its progress in England and Wales was truly astonishing. The general use of pit-coal, most unquestionably, occasioned an earlier relinquishment of many of the charcoal works than would otherwise have been the case, but the manufacture had so much increased as to render this an object of trifling importance.

The following statement shows the manufacture of charcoal pig-iron in England and Wales in the year 1788:—

up and made air tight, having only two apertures, one to receive the supply of air from the air-pump, and the other to admit a pipe that conducts the condensed air to blow the two furnaces.—*Sir J. Sinclair's Statistical Account of Scotland*—1793.

	No. of Fur.	Tons at each.	Total in each county.
Gloucestershire............	4	650	2600
Monmouthshire	3	700	2100
Glamorganshire	3	600	1800
Carmarthenshire	1	400	400
Merioneth................	1	400	400
Shropshire................	3	600	1800
Derbyshire	1	300	300
Yorkshire	1	600	600
Westmoreland	1	400	400
Cumberland	1	300	300
Lancashire	3	700	2100
Sussex	2	150	300
Total....	24		13,100

	Tons.	cwt.	qr.
Average produce from each furnace	545	16	2
Former average produce (page 57)	294	1	1
Total....	251	15	1

Increased produce from each furnace, from the year 1740 to the year 1788, attributable entirely to the general improvement in machinery and the introduction of the steam-engine, 251 tons 15 cwt. 1 qr.

About the year 1740 the annual quantity of charcoal pig-iron manufactured in England and Wales amounted to 17,350 tons; in 1788 the quantity was 13,100 tons—being a decrease in that period of 4250 tons, attributable chiefly to the decrease of wood, but also, as we have before stated, to the use of pit-coal as a substitute for charcoal in the furnace.

In the year 1788 the manufacture of coke pig-iron was as follows:—

	No. of Fur.	Make of each.	Total in each county.
Shropshire................	21	1100	23,100
Staffordshire..............	6	750	4,500
Derbyshire	7	600	4,200
Yorkshire	6	750	4,500
Cumberland	1	700	700
Cheshire	1	600	600
Glamorganshire	6	1100	6,600
Brecknockshire	2	800	1,600
Staffordshire, 3 new furnaces expected to be in blast the same year	3	800	2,400
Total....	53		48,200

	Tons.	cwt.	qr.
Average annual produce at each furnace......	909	8	2
Total of charcoal pig-iron	13,100	0	0
Ditto of coke pig-iron	48,200	0	0
Total....	61,300	0	0

—being a total of 61,300 tons of pig-iron manufactured in England and Wales. At the same period there were erected, and in blast, in Scotland, in the West Highlands:—

	Charcoal Fur.	Make of each.	Total in each county.
Goatfield	1	700	700
Bunawe	1	700	700
There were also—			
Carron .... Coke fur.	4	1000	4000
Wilsontown, or Cleugh	2	800	1600
Total....	8		7000

—being a total quantity of 7000 tons of pig-iron manufactured in Scotland.

Average produce at each furnace..................876 tons.

Furnaces.		Tons.
77	Total quantity of pig-iron made in England and Wales	61,300
8	Ditto, ditto, in Scotland	7,000
85		68,300
59	Annual quantity manufactured preceding the introduction of pit-coal for furnace fuel	17,350
26	Total increase....	50,950

As the period of 1788 or 1790 may be considered a new era in the history of the manufacture of iron, arising from the more general use by the iron masters, of the double power engine of Mr. Watt, it may prove interesting to give a short account of the introduction of this most valuable machine.

Notwithstanding various attempts by the Marquis of Worcester,* and others, to construct a steam-engine, no machine

* The Marquis of Worcester was the inventor of the steam-engine, or a machine in which the elastic force of steam was proposed as the first mover in raising water. In his "Century of Inventions," a work published in 1663, he has described this

of this kind appears to have been completed and applied to actual use, before the invention of Capt. Thomas Savery, treasurer to the commissioners of sick and wounded. In a pamphlet entitled "The Miner's Friend," published in 1696, he describes a steam-engine, in which water is raised not only by the expansive force of steam, but also by its condensation, the water being raised by the pressure of the atmosphere into receivers, from which it is forced to a greater height by the elastic force of the steam. After having erected several of these engines, Savery took out a patent, in 1698, for a new invention "for raising water, and occasioning motion to all sorts of mill work." In June, 1699, he exhibited a working model to the Royal Society, who printed in their Transactions for that year a drawing and description of it; but the most complete account of it appeared in a small pamphlet of eighty-four pages 12mo., which Mr. Savery published in 1707, under the title of "The Miner's Friend, or an Engine to Raise Water by Fire Described; and the manner of fixing it in mines, with an account of the several uses it is applicable unto, and an answer to the objections made against it." This book was separately addressed to King William III., to whom the engine had been shown at Hampton Court.

Various engines on the principle of Mr. Savery's have been erected since his time, and various improvements made on the original construction—amongst others by Dr. Desaguliers, but before his improvements were proposed, a very important invention had been made by Mr. Thomas Newcomen, an ironmonger at Dartmouth. There is reason to believe that this ingenious workman was occupied in the improvement of the steam-engine as early as Mr. Savery. Switzer, indeed, who was a friend of Savery's, and therefore not likely to make any statement injurious to his reputation, distinctly informs us that he had good authority for stating that Newcomen was as early in his invention as Savery, but that the latter, being nearer the Court, obtained his patent before the other knew of

engine, in No. 68, and he has again referred to it in Nos. 98, 99, and 100. He has also left behind him, what he calls "A Definition of his Engine"—the only copy of which is preserved in the British Museum.

it, on which account Newcomen was glad to come in as a partner in the patent, which was granted to them in 1705.

Desaguliers, however, has given a different account of the matter, and as the passage contains some interesting details, we shall give it in his own words:—"Thomas Newcomen, ironmonger, and John Calley, glazier, of Dartmouth, made the several experiments in private, and having brought the engine to work with a piston, &c., they, in the latter end of the year 1711, made proposals to draw the water at Griff, in Warwickshire; but their invention meeting not with reception, in March following, through the acquaintance of Mr. Potter, of Bromsgrove, in Worcestershire, they bargained to draw water for Mr. Bach, of Wolverhampton, where, after a great many laborious attempts, they did make the engine work; but not being either philosophers to understand the reasons, or mathematicians enough to calculate the powers, and to proportion the parts, very luckily, by accident, found what they sought for. They were at a loss about the pumps, but being so near Birmingham, and having the assistance of so many admirable and ingenious workmen, they so soon came to the method of making the pump valves, clacks, and buckets, whereas they had but an imperfect notion of them before."

The engine thus constructed has received the name of the atmospheric engine, in consequence of the power which is employed, being only the weight of the atmosphere, the steam exerting no force whatever, either upon the surface of the water, or upon the piston, and having no other functions to perform but that of forming a vacuum.

But to the great and comprehensive genius of the late Mr. Watt are we indebted for those improvements, which have rendered the steam-engine the present powerful agent of our iron works and other manufactures. When Mr. Watt's attention was turned to the subject of steam, in 1759, it was then an effective and useful machine, and was used to a considerable extent in the mines and manufactories of the kingdom; but though it was then an effective machine, it was a very imperfect one, and required for its improvement all the

energies of a mind deeply imbued with mechanical and chemical knowledge.

Mr. James Watt was a maker of mathematical instruments at Glasgow, and being a man of a truly philosophical mind, and well conversant with all branches of science, he was in the habit of associating with the most celebrated scientific men at that time in Scotland, particularly with Dr. Black, Dr. Roebuck, and Dr. Robison. In the year 1761 or 1762, Mr. Watt had constructed a model, with which he showed the practicability of what is now called the high-pressure engine; but it was not till 1763, when he was repairing a working model of Newcomen's engine, belonging to the college at Glasgow, that his mind was usefully directed to the subject; during this employment, he observed the great loss of steam from the condensation of the cold surface of the cylinder. He made various experiments during the ensuing year to obviate this, but it was not until early in 1765 that it occurred to him, that if a communication were opened between a cylinder containing steam, and another vessel exhausted of air and other fluids, the steam would immediately rush into the empty vessel, and continue to do so till it had established an equilibrium, and if that vessel were kept very cool by an injection or otherwise, more steam would continue to enter, until the whole was condensed. Thus did he discover the great principle of condensation in a separate vessel.

Mr. Watt was so much occupied in other business, that it took him much time to complete his machine, and bring the whole to bear, so that he did not apply for his first patent until 1768, which bears date January 5, 1769, and is for his "methods of lessening the consumption of steam, and, consequently, of fuel in steam-engines."

Soon after his patent was obtained, Mr. Watt became associated with Dr. Roebuck; they proposed establishing an extensive manufactory for such engines under the patent, and Mr. Watt began his first real engine, of eighteen inches cylinder, at Kinneil, near Borrowstownness. This was a sort of experimental engine, and was successively altered and improved till it was brought to considerable perfection. In the

details of its construction, the greatest difficulty of all was the packing of the piston, so as to be steam tight, because Mr. Watt's principle did not admit of water being kept upon the piston, to prevent the leakage, as in the old engines.

He found great difficulties in procuring a cylinder sufficiently accurate, until a new method was introduced at Burham foundry, by Mr. John Wilkinson.* In the old method of boring, the instrument which performs the part of cutting the metal was guided in its progress by the incorrect form given to the cylinder by the moulder, and although it insured that every part of the cylinder should be circular, it gave no certainty that the cylinder should be straight. This was quite sufficient for the old engines, but Mr. Watt's engines required greater precision. Wilkinson's machine insured the accuracy required, and if the cylinder was cast ever so crooked, the machine would bore it straight and true.

Dr. Roebuck becoming embarrassed, from the failure of his vast undertaking in the Borrowstownness Coal and Salt Works, was unable to prosecute the manufactory of steam-engines; and, in 1774, disposed of his interest in Mr. Watts' patent to Mr. Matthew Boulton, whose establishment at Soho, near Birmingham, was then the most complete in England, and conducted with the most spirit. A portion of the works was allotted to Mr. Watt, who erected a foundry and the necessary works to carry his invention into effect, on a grand scale.

In consequence of the great loss of time, and the enormous expense necessary for bringing the engine to perfection, Mr. Watt was not able to produce any large engines, as specimens of his invention, until 1774; and found, from the difficulty of introducing them, that the term of his patent was likely to pass away before he should be reimbursed; he, therefore, applied to Parliament for a prolongation of his term, which was granted for twenty-one years, by an Act passed in 1775,

* Mr. Wilkinson was the first who applied steam-engines to blow the furnaces.—*Lord Sheffield's Observations on the Manufactures, Trade, and Present State of Ireland*—1785.

the period to commence from the expiration of his first patent.

With this encouragement, and with the advantage of Mr. Boulton's assistance in systematising the manufacture of the parts, Mr. Watt soon produced many capital engines, which were erected in Staffordshire, Shropshire, and Warwickshire, and a small one at Stratford, near London, but chiefly in Cornwall; and Messrs. Watt and Boulton granted licenses to use their engines, on securing a third part of the saving in coal, compared with an atmospheric engine performing the same work with coals equal in quality. The amount of this saving was determined by ascertaining experimentally the coals consumed during any number of strokes made by the common and the improved engine. The number of strokes made in any given interval, was ascertained by a piece of machinery called the counter, which was struck at every ascent of the working beam. Two keys of this machine were kept, one by the patentees, and the other by the proprietors; and a traveller, who examined it at stated times, calculated the saving of coal from the number of strokes.*

The regular and increased effects of this very powerful machine were soon felt in most of the iron districts. The produce of the furnaces greatly increased as to the quantity of metal, and as the proprietors of the works became more prosperous, other capitalists were induced to engage in similar undertakings. Another cause also operated at this time, namely, the high price of foreign iron,† and the vexatious

* For three large engines, at Chacewater mine, in Cornwall, the proprietors paid 800*l*. annually, instead of the third of the saving of coal.—*Edinburgh Encyclopædia*—Art., "Steam Engines."

† The iron used at the Cramond Works comes chiefly from Russia and Sweden, upwards of 1000 tons being imported from the Baltic yearly. The average cost per ton (including customs at 56*s*. and freight from 8*s*. to 15*s*.) is 17*l*. for Russia and 18*l*. 10*s*. for Swedish iron; but a very fine kind of the latter, the produce of the famous mine of Dannemora, called Oregrund iron, from the port where it is shipped, comes to 24*l*. per ton. This sort is used solely for making steel. These different kinds of iron are 50 per cent. dearer than they were in 1780, which rapid advance has lately induced the proprietors to erect furnaces at Clyde, near Glasgow, with

proceedings of the Russians, who imagined that we were completely at their mercy for the necessary supply of iron. New works were yearly erected, and several furnaces were annually added to those already in blast, and the increase was so considerable that, in the course of eight years, the manufacture of pig-iron was nearly doubled, as will appear by the following returns, which were sent to the chairman of the committee of the House of Commons, on the subject of the coal trade, when Mr. Pitt, in the year 1796, had it in contemplation to add to the revenue by a tax upon coal at the pit-mouth. This, of course, led to a powerful opposition on the part of the manufacturing consumers, and particularly so, as may easily be imagined, in the iron trade. A committee was appointed—witnesses examined—facts collected—and the measure abandoned, as being unwise and impracticable.

Names of Furnaces.	No. of Fur.	Excise return.		Sup. quanty.	Exact return.	
		T.	*c.*	*Tons.*	*T.*	*c.*
	CHESTER.					
Apedale	1	2100	0	1000	728	10
Silverdale	1	2600	0	1200	1230	0
	CUMBERLAND.					
Bearpost	1	2080	0	1200	240	0
Dudden	1	1664	0	400	325	0
Newland	1	700	0	700	700	0
Backbarrow	1	700	0	700	769	0
	DERBY.					
Dale Abbey	1	474	0	474	443	0
Mersey Park	1	728	0	728	728	0
Buttersby	1	936	0	936	936	0
	GLOUCESTER.					
Flaxley	1	360	0	360	360	0
Forest of Dean	1	20	0	20	20	0
	HEREFORD.					
Abbey Tintern	1	70	0	70	70	0
Bishopwood	1	500	0	500	947	0
Cornbrook	1	1000	0	1000	482	0
Bringwood	1	500	0	500	250	0
Leighton	1	780	0	780	780	0

the view of making bar-iron for Cramond, which they hope will, in a few years, furnish them with sufficient materials, and save the great sums remitted for that article.—*Sir J. Sinclair's Statistical Account of Scotland*—1791.

Names of Furnaces.	No. of Fur.	Excise return. T. c.	Sup. quanty. Tons.	Exact return. T. c.
		LINCOLN.		
Renishaw	2	500 0	500	705 0
		SALOP.		
Old Park................	3	11332 10	6240	5952 0
Horschay................	1	4927 10	2080	1458 4
Lightmoor	3	8946 0	6240	3498 15
Coalbrooke Dale..........	3	7175 0	4162	2659 11
Madeley Wood	1	3777 10	2080	1856 8
Jackfield	2	7086 0	4160	1820 0
Benthal	1	2367 10	1600	1334 0
Willey..................	1	3702 10	1600	1554 10
Brosely	1	1775 0	1400	1076 10
Kepley..................	3	7590 0	6210	5068 19
Sondshill	2	4730 0	3400	3367 0
Donnington Wood	2	4720 0	4160	3323 0
		SUSSEX.		
Ashburnham	1	172 15	173	173 0
		WALES—SOUTH.		
Clydach	1	1820 0	1820	1625 0
Blaendare	1	1404 0	1404	1500 0
Blaenavon	3	5460 0	5460	4318 0
Sirhowy	1	1820 0	1820	1930 0
Beaufort	1	1560 0	1560	1660 0
Penyca, or Ebbervale......	1	1560 0	1560	397 0
Hirwain	1	1400 0	1400	1050 0
Melinicourt..............	1	648 0	648	503 0
Ennisygedyr	1	1352 0	1352	800 0
Caerfilly	1	600 0	600	695 0
Cyfartha	3	6000 0	6000	7204 0
Plymouth	1	2000 0	2000	2200 0
Pendarron	2	4000 0	4000	4100 0
Dowlais	3	4100 0	5400	2800 0
Llanelly	1	1664 0	1664	1560 0
Neath Abbey	2	3120 0	3120	1759 0
		WALES—MIDDLE.		
Dovey	1	200 0	200	150 0
		WALES—NORTH.		
Ruabone................	1	1560 0	1560	1144 0
Brymbo	1	884 0	—	——
Brymbo-gate	0	728 0	—	——
Ponyrron................	0	1498 0	Lead work	——
Pentrobn................	0	1560 0	Ditto	——
		WALES—WEST.		
Carmarthen..............	1	1056 0	1056	290 0

Names of Furnaces.	No. of Fur.	Excise return.		Sup. quanty.	Exact return.	
		T.	c.	Tons.	T.	c.
		STAFFORD.				
Level	1	1560	0	1560	1391	0
Brierly	1	1300	0	1300	1046	10
Duffield	2	2600	0	2600	2526	0
Bilston	2	2340	0	2340	1429	0
Bradley	3	3640	0	3000	1920	0
Grave-yard	1	1260	0	1336	213	0
Dudley Port	1	1040	0	1040	869	0
Tipton	2	2060	0	2080	2203	0
Gospel Oak	1	——		—	1613	0
		YORK—LEEDS.				
Bowling	2	2000	0	2000	2000	0
Wibsey Moor	2	2000	0	2000	2500	0
Shelf	1	1000	0	1000	1140	0
Birkenshaw	1	780	0	780	846	0
		YORK—SHEFFIELD.				
Chesterfield	1	940	0	940	940	0
Little Brampton	2	1800	0	1800	1560	0
Winger Worth	1	1274	0	1274	1274	0
Stavely	1	1000	0	1000	761	1
Park	1	1092	0	1092	853	0
Chapel	1	1456	0	1456	1456	0
Horncliffe	2	1092	0	1092	712	0
Elsbar	1	800	0	800	950	0
Bretton	1	250	0	220	250	0
Holmes	3	6000	0	6000	2000	0
Total....	104	167,312	0	133,965	108,973	0
		SCOTLAND.				
Carron	4	5200	0	5200	5616	0
Wilson Town	2	——		2080	2080	0
Muirkirk	2	——		3120	2878	0
Clyde	3	——		3640	2216	0
Omoa } Devon }	2 } 2 }	——		3000	2396	0
Goatfield—charcoal	1	——		1600	300	0
Bunawe—ditto	1	——		—	600	0
	17	5,200		18,640	16,086	
	104	167,312		133,965	108,993	
	121	172,512		152,605	125,079	

Average produce of each of the English and Welsh furnaces .. 1048 tons per ann.
Ditto of the Scotch furnaces .... 946 „

The demand for iron articles of all kinds in this country not only continued unabated after the period of 1796, but kept increasing in a greater ratio than formerly, so that, in the short space of five years, situations were occupied for nearly fifty additional furnaces, or additions made to established works of that extent. In 1801 and 1802 it was ascertained that the following new furnaces were either building, or actually in blast, in England, Wales, and Scotland:—

	Furnaces. In Blast.	Furnaces. Building.		Furnaces. In Blast.	Furnaces. Building.
Silverdale	1	0	Duffield	1	0
Snidshill	2	0	Gornall Wood	1	0
Wibsey Moor	1	0	Brierly Hill	1	0
Kittry	1	0	Near Wolverhampton	0	1
Madily Wood	1	0	Dudley Wood	0	5
Burnit's Leason	1	0	Billingsly	0	1
Newcastle, Staffordshire	0	1	Newcastle-upon-Tyne	0	2
Cyfartha	1	0	Bilston	1	0
Llanelly	1	0		—	—
Sirhowy	1	0		20	20
Beaufort	1	0			
Plymouth	1	0	SCOTLAND.		
Union	0	1	Muirkirk	1	0
Aberdare	0	3	Glenbuck	1	0
Tipton	1	1	Calder	0	2
Bloomfield	0	1	Markinch	0	2
Longacres	0	1	Shotts	0	1
Wednesbury	0	1		—	—
Staffordshire	1	0		2	5
Coleford	1	0	England and Wales	20	20
Jackfield	1	0		—	—
Old Park	0	1		22	25
Donnington Wood	0	1			

Making the total number of new furnaces in blast and building in Great Britain forty-seven.

The great increase in the manufacture of iron attracted the notice of government, and, in the year 1797, Mr. Pitt, then Chancellor of the Exchequer, proposed laying a duty of 20*s.* per ton on pig-iron, but, after full consideration, he abandoned the idea. Lord Henry Petty, however, revived the subject in the year 1806. He proposed to levy a duty of

40*s.* per ton on pig-iron, as a war-tax, and submit its various processes to the constant inspection of Excise officers. There were, at this time, 133 iron works in Great Britain, the proprietors of which met in the several districts, and deputed fourteen of their body to assemble in London, and arrange the information submitted to the committee of the House of Commons on the bill for imposing this tax; showing its impolicy and ruinous tendency on a manufacture which is essential to the success of almost all branches of British industry.

The following is an abstract of a statement which the deputation prepared of the several furnaces, which, in the spring of the year 1806, were working with cokes of pit-coal, and charcoal, in England, Wales, and Scotland.

No. of works.	Counties.	Number of Furnaces. In blast.	Out.	Total.	Tons pig iron made ann.	Av. tons p. Furnace.
4	Cumberland......	4	0	4	1,491	373
11	Derbyshire	12	6	18	10,329	861
2	Gloucestershire....	2	1	3	1,629	815
3	Lancashire	2	2	4	2,500	1250
1	Leicestershire	0	1	1	—	—
3	Monmouthshire ..	3	0	3	2,444	815
19	Salop	28	14	42	54,966	1963
25	Staffordshire......	31	11	42	49,460	1595
14	Yorkshire........	23	4	27	26,671	1160
82	Total in England	105	39	144	149,490	1424
25	South Wales......	36	11	47	75,601	2100
3	North Wales......	3	1	4	2,075	692
12	Scotland..........	18	9	27	23,240	1291
122	Total coke furnaces in Gt. Britain	162	60	222	250,406	1546
11	Old charcoal furnaces still in use in different counties......	11	0	11	7,800	709
133	Total Gt. Britain	173	60	233	258,206	—

Making the average annual produce of each of the 162 coke furnaces in blast 1546 tons.*

* But this general average will not show the effect produced at those works

By this document it appears that, of the 233 furnaces then erected, sixty were out of blast, and that the remaining 173 furnaces produced the astonishing quantity of 258,206 tons of pig-iron—being an increase in ten years, from 1796, of no less than 133,127 tons per annum; and, during the same period, there were erected, as we have already seen, to the year 1802, forty-seven new furnaces, and, subsequently, up to 1806, sixty-five additional ones, making, however, some allowance for the furnaces, if any, which were out of blast in 1796.

It was calculated that 95,000 tons were converted into bars and other descriptions of iron; that the capital employed in the manufacture was five millions sterling, and that it furnished employment to 200,000 persons.

When Lord Henry Petty proposed this tax on pig-iron, he stated—"This tax was formerly in contemplation, and as the object is now greatly extended in use, and as 130,000 tons was the quantity then manufactured, I apprehend that the quantity may now be estimated at 250,000 tons, which, at 40*s.*, will be 500,000*l.* Upon this head there will be countervailing duties on foreign iron, and a fair drawback will be allowed. This tax will be under the Excise."

An account was moved for, and ordered, of the quantity of iron consumed by the Ordnance, and of the iron purchased for the Navy. This account was accordingly presented to the House by Mr. Vansittart, and a copy, embodied in an account, headed "Estimate of the Net Produce of the Duty

where powerful engines were erected; it will, therefore, be desirable to notice, that at some of these, as at Cyfartha, in South Wales, the average per furnace is as high as 2615 tons per annum, while, in twenty-three others, the quantity falls below 500 tons, being, at Dovey, in North Wales, stated at only 150 tons per annum.

Seventeen of these works make 4000 tons each, or upwards, of which the six largest are—

Cyfartha, in South Wales....	10,460	tons per annum.
Blaenavon..................	7,846	,,
Penydarren	7,803	,,
Old Park, Salop	8,359	,,
Kepley	7,510	,,
Carron, Scotland	7,380	,,

upon Iron," was transmitted to the deputies of the iron trade, who replied to it by counter statements.*

Upon the second reading of the bill, Sir John Wrottesley asked, "Whether anything was proposed to be done to obviate the difficulty of giving a sufficient drawback to the manufacturers engaged in the export trade? A number of gentlemen in town, whose opinions deserved the attention of the House, thought the proposed drawback insufficient, as it seemed the utmost to be allowed did not exceed 4*l.* per ton. The deductions on account of the Ordnance and Naval stores would be considerable."

Lord Henry Petty stated "the amount of deduction for iron used in the Ordnance and for the Navy department to be altogether 51,460*l.*; the drawbacks on foreign iron 13,770*l.*; that on British iron 123,000*l.*—making a total, with 5000*l.*, the estimated expense of the collection, of 193,000*l.*, to be deducted from the produce of the tax. The average of the drawback was 4*l.* a ton."

Mr. Vansittart observed, "that 4*l.* per ton had been calculated upon as an average, and not as the highest allowance."

The bill was then read a second time and committed. When the bill came under discussion, the opposers of the measure contended that it had hitherto been our uniform policy not to tax articles that were the staple commodities of the country, such as iron, coals, or wood. That of all these commodities iron might be considered the most important, and any tax upon that article must be injurious to the general interest, but the operation of this tax particularly so. It was proposed to lay an equal duty on iron of all qualities, although there was a variation of at least 50 per cent. in the value of different kinds. How, therefore, could this proposition be reconciled with the principles of justice? The uses of iron were so multiplied, that it was probable they had not been taken into consideration. With respect to iron of the lowest quality—in the article of iron railways from mines, the operation of the tax would increase the

* See Appendix C.

expense of such railways 700*l.* a mile—an expense which would almost amount to a prohibition of them. It had been found desirable to abolish wooden railways for the purpose of substituting iron ones—an object which this tax must in a great measure defeat. Yet it would, even then, be felt most severely in the construction of those wooden railways. The ramifications of injury that the tax would cause were innumerable. On a moderate calculation, it would raise the price of coals 1*s.* per ton. The quantity imported into London within the year exceeded a million of chaldrons. Thus, from this small advance, 50,000*l.* would arise. The utmost at which the friends of the tax computed its annual amount was 300,000*l.* The opponents of it thought it would not be so much. The additional charge, therefore, merely on coals brought to London, came to a sixth of the whole produce of the tax.

Another baneful effect of the tax would be, that, by its operation on the machinery of our manufactures, horses would be substituted in many cases, and this at a time when we were paying millions annually to the continent for foreign grain. At the present moment iron was applied to purposes for which large timber would then be used. Would it be wise to increase the demand for timber of this description, at a period when it was already so alarmingly scarce? With regard to iron of the higher and finer kind, in many manufactures it had to pass through three or four different hands. In each of these stages an augmentation of price would take place.

With respect to the tax as it affected the manufactures, the agriculture of the country, and the comforts of the poor, it would raise the price of many of those manufactures in which iron was principally employed 12½ per cent., and in some cases much higher. This was a most serious consideration to the country, when the manufactures of Flanders, of Prussia, and of Styria, were able to come into competition with us in the foreign markets, and even to undersell us in the coarser articles.

The seats of the great manufacture of iron ware had been

seriously affected by the wars on the continent, and this tax would have on them the most injurious effects. Its influence on agriculture would also be pernicious; it would tend to give the grazing farmer, who made less use of horses and implements of iron, great advantages over the arable, and thus would throw an undue proportion of the country into pasture. It would press heavily also on the poor —iron was a necessary part of most of the tools which they employed, and thus the very implements which they used might be placed almost beyond their reach.

The effects of this measure must inevitably be to throw a gloom on the spirit of our manufactures—to cut up those very resources to which the country would have to look for its protection and defence, and to deprive of bread very numerous classes of our industrious poor. It would have the most injurious effects on a very large proportion of the inhabitants of Birmingham—which place had been formerly called the toy-shop of Europe; but since the convulsions that had taken place on the Continent, the demand for those articles of curious and elegant manufacture had entirely ceased, and goldsmiths and silversmiths were now converted into blacksmiths. Even in their articles, Germany and America had now begun to enter into competition with us. The manufactures of these countries had received every encouragement from their different governments, and surely our own manufactures were equally entitled to the fostering care of our own legislature.

The difficulties attending the proper allowance of drawbacks were very great; the orders for the foreign market were all made up in large casks, and it would be necessary to submit them to the inspection of the exciseman—that the whole would be vexatious in the extreme. That if the rising manufacture of unwrought iron remained untouched, it would prove a resource of incalculable riches to the country; but, should it be strangled in its infancy by the hands of the exciseman, the country would have reason to curse the hour when such a tax had been imposed. It was by our trade and manufactures that we were enabled to hold such a distin-

guished rank among the nations of the world; and, while these were not discouraged by our own government, we had no reason to fear that the efforts of Buonaparte would ever be able to drive them from the markets of Europe. They would continue to find their way into every part of the habitable globe.

It was acknowledged that the situation of the Minister of Finance had, of late, every year grown more and more difficult, since almost every object of taxation had already been resorted to. It had, therefore, become difficult to select a tax that was not liable to some objections—but the present tax appeared peculiarly objectionable. It had been well observed, that the possession of iron was one of the great grounds of distinction between civilised and barbarous society; and in the same proportion that this country had improved in manufactures and civilisation, the manufacture of iron had been extended and improved, and had found its way, by numerous meandering streams, into every department of civil life.

The number of those employed in producing the raw material, and of those who afterwards wrought it up into every article of utility or elegance, was very great; these were mostly men of athletic make and great bodily vigour, which was a consideration of no small consequence in viewing the general utility of a manufacture, since it had been justly said, that too many of our manufactures tended to deteriorate the physical constitution, and produce a feeble and degenerate race of men, without spirit or ability to defend their rights. In this view alone the manufacture of iron, in all its branches, was highly deserving of encouragement, and any obstruction given to its progress greatly to be deprecated.

It was computed that between 400,000 and 500,000 persons were engaged in the various branches of the manufacture; and when it was considered how much every one of them contributed to the revenues of the state, by the produce of his industry, it became a matter of serious consideration whether the sum proposed to be raised by this tax would not be more than countervailed by those defalcations in other parts of the

public revenue, which would arise from the discouragement given to the iron manufacture by the present tax.

This tax had been proposed to the House ten years ago, and had then, upon full consideration, been withdrawn. It was then proposed to lay on a duty of only 20s. per ton, but the late Chancellor of the Exchequer saw reasons, at that time, to decline the prosecution of the measure; it was one of the characteristics of that great man (Mr. Pitt) candidly to give up any measure which, on investigation, he found inexpedient, without dreading the charge of inconsistency or indecision.

The manufacture of iron had this peculiar recommendation belonging to it, that it had arisen and flourished most in those parts of the country which Nature seemed to have doomed to everlasting sterility; and, as Mr. Wilberforce observed, "he had never felt a more sensible pleasure in his life than when, after the lapse of a few years, he had returned to a spot once rugged and barren, but then covered by the fruits of human industry, and gladdened by the face of man, in consequence of the introduction of this manufacture."

It was a received principle of taxation that no duty should press upon any article in its rude and early state, since it caused an uniform rise of price in every article into which it was afterwards wrought up. In this instance, though the sum that would enter the Treasury would not be more than 200,000*l.*, yet a tax of nearly a million would be raised from the community at large. This was a prodigal waste of those resources which ought to be husbanded for future demands, and which the public spirit of the country would cheerfully contribute whenever they were called for by the necessity of the times. It was a sound principle of taxation, that every tax should be as little vexatious as possible in its collection, for the tax on the feelings of the subject might be more galling than that on his pocket. The application of the excise to any branch of commercial enterprise was to be regretted; but, in this instance, it would prove more than usually vexatious, from the number of those engaged in the manufacture, from the multifarious variety of the articles, but,

above all, from the artisans being hitherto completely unaccustomed to the operation of excise laws. Within the short space of nine years, the manufacture of iron had been more than doubled. The annual produce had then been 100,000 tons, but it had now risen to 250,000; it was, therefore, our duty to foster its progress and not to check it. This tax would cause an increase of price to the amount of 10, 15, and even 20 per cent. The proposed drawback was greatly too small; government had estimated that it would amount to 150,000*l.*, but the manufacturers calculated that 266,000*l.* would be requisite.

It was a fact, that, even at present, some of the German manufacturers were able to furnish their articles cheaper than they could be produced in this country, and the tax would tend still more rapidly to drive us from the foreign market. There were considerable quantities of iron used in canals, bridges, ship-building, and agriculture, on all which the tax would severely operate. If the requisite sum could be raised in another way, why impose it on a manufacture of universal application? It was said to be an argument in favour of the bill, that it would operate generally — it would certainly operate as a general burden, but it would not be generally productive.

The supporters of the bill, on the other hand, argued that it was a principle of taxation to lay the tax on articles that were most diffusive, and, consequently, would be most productive. It was thought that necessaries ought not to be taxed, and that every thing should fall on luxuries. All the papers before the House showed that the opposition to the bill came from the manufacturers, not the consumers. As to foreign consumption, the tax could have but little effect; it was not the quantity, but the quality, of our manufactures, which was looked to. If we talked of exempting necessaries from taxation, we must give up every resource, and tax nothing.

The use of iron for the purpose of agriculture had been mentioned as an objection to the tax, but the consumption of that article, in this respect, was trifling when compared with

its consumption in our West India plantations, where it was used, instead of copper, for boilers and other culinary purposes. The present tax could not affect our articles of hardware in the foreign market, as the demand for those articles did not depend on their price, but arose from their superior quality. In this respect no foreign manufacture was likely soon to rival us.

It had been stated that the iron trade was not yet ripe enough to produce a revenue. If the iron trade had doubled, as it was admitted had been the case, within the last ten years, it was impossible to deny that it was a fit object for taxation, considering the state of the country, and the necessity there was for making every article contribute to the present exigencies, considering the high duty on malt and even on salt; and considering the great and extraordinary length to which the income tax had been carried this year, it was rather matter of surprise that the present tax had not sooner been thought of. If it could be made out that, by proper drawbacks being allowed, no loss would arise to our foreign market, and at the same time that a great increase would thereby arise to the revenue, of probably 300,000*l.* or 400,000*l.*, it would require some reasoning stronger than had been yet heard, to prove the tax ought not to be adopted. The objections to the Excise would have been perfectly applicable to the first introduction of the Excise laws into this country. The gentlemen now sought to be put under the regulations of Excise would not have the same necessity for frequent visits from the officers as others had.

To show that the excellence of the manufacture was that which recommended it to foreign markets, the great fluctuation which had taken place in the prices, being to the extent of upwards of 20 per cent., was instanced, which, nevertheless, had no effect on the amount of the exports; and, by taking a comparative view of the drawbacks acknowledged by the dealers themselves to be sufficient, and those proposed to be granted by the present bill, showed that the drawbacks which it was in the contemplation of the framers of the bill to allow, were fully sufficient.

It had been stated that the House had always abstained from imposing taxes on the raw material, and particularly iron. It was but lately that iron came to be manufactured to any great extent in this country, but the taxes on foreign iron were multiplied session after session; and, in fact, there were many other taxes which acted as a direct tax on iron, and which never were opposed, namely, the taxes on wood and coal. This tax would not destroy the great iron works, the roads and bridges. The same argument would apply to that which applied to the foreign trade, namely, that the fluctuation in the price never put a stop to these great works, though it differed so much as to be, in the year 1799, 16*l.* a ton; in 1803, 19*l.*; and immediately after that, to fall to 14*l.*; and yet the fluctuation had no effect on the trade. The statements that had been referred to were much exaggerated, and the drawbacks in the bill were sufficient to cover the trade from the effect of the tax. In some instances the drawback proposed to be allowed exceeded that demanded by the manufacturers: in others they were less, but every liberality would be extended, and the drawbacks might be modified or extended, so as to be satisfactory to those concerned.

As to the excise, no harsh provisions on that head existed in the bill—indeed, such provisions were unnecessary, because a bar of pig-iron could not easily be smuggled.

The tax would bear so small a proportion to the immense capital employed in such concerns, that they could not be materially affected thereby. There was nothing in the state of the countries on the Continent to give rise to the apprehensions entertained with respect to the foreign trade. As to America, it was a country in the infancy of its population, and no wise government would encourage in such a country the employment of its subjects in manufactures to any extent that would enable them to rival this country. The population of that country would be wisely directed to the more productive employment of cultivating their country.

In reply to these arguments, the opposers of the bill stated that the fluctuation in the price of iron, although it was great,

could not have had any effect on the foreign markets, as, when iron was dear, we exported very little, on account of our hostility with the northern powers. At that time the demand was so great at home, that, to use a tradesman's expression, the pigs were not allowed to be cold before they were taken away. This demand, of course, raised the price of the commodity, but, some time after, it was lowered considerably, on the suggestion of the manufacturers, who declared that they would be unable to proceed with their business unless they had the raw material considerably cheaper. Much of the flourishing state in which that trade now was, should be attributed to the ingenuity of the persons concerned in it, and nothing could so effectually put a stop to the exertion of this ingenuity as putting the manufacture under the Excise. Formerly, and till within the last few years, wood or charcoal was the only material by which it was supposed that iron could be made, but the ingenuity of the manufacturers led them to find a substitute in coke. Under the gloomy influence of the Excise, there was every reason to believe that this useful discovery would never have been made. The moment the legislature put on the Excise, they imposed a specific mode of working, from which no appeal could be made, and which must at once put a stop to ingenuity. Insuperable difficulties presented themselves to the execution of the plan laid down. The manufacturers were called on to give notice to the Excise officer of the time at which they were to proceed to work. This was impossible: with all their practice and skill in their business, they could not judge within four hours of the time it might be in their power to open the furnace and proceed to cast, and the Excise officer must be always on the spot, or the manufacturer must be under innumerable penalties. The door must always be open to great frauds. Nothing could be so unjust as to confer on the fraudulent manufacturer the means of evading the duty, and of underselling the fair dealer.

Notwithstanding this powerful opposition, the ministers persisted in carrying the bill into a committee, and the House

divided upon the question. Upon the division there appeared 119 in favour of the bill, and 109 against it—leaving to ministers a majority of only 10 members; but in a few days after the House had resolved itself into a committee, the ministers were induced to abandon the measure altogether.

CHAPTER VI.

GREAT BRITAIN (CONTINUED).

In the years 1783 and 1784, Mr. Cort, of Gosport, obtained two patents, one for the puddling, and the other for the rolling of iron—discoveries and improvements of so much importance in the manufacture, that it must be considered the era from which we may date the present extensive and flourishing state of the iron trade of this country; but, preparatory to noticing his inventions, it will be necessary to give an account of the processes hitherto in use for the conversion of iron into malleable or bar-iron.

The ancient and modern methods of extracting iron from its ores differing very materially from each other, it will be necessary to treat of them separately.

Iron,* as it exists in the ore, whether in a state of greater or less oxidation, is capable of being brought to the metallic state, when heated in contact with charcoal, by a much lower temperature than is required for its actual fusion; and the iron being brought to this state, the earthy matter with which it is mixed may be vitrified by the adoption of a proper flux, so as to allow the particles of metallic iron to subside, in consequence of their specific gravity, to the bottom of the mass, although they are only in that soft pasty state which common bar-iron exhibits when it is at a white heat. Now, the blowing machines of the ancient metallurgists being greatly inferior to those which are employed at present, they were obliged to make use only of the richest and most easily reducible ores; and even these they were never able, properly

* Aikin's "Chemical Dictionary."

speaking, to fuse in quantity, so that cast-iron was a modification of this metal wholly unknown to them.

That iron which was termed the best, was prepared in the following manner :—A mass of brickwork was raised five feet in length and breadth, and three and a half feet high, resembling a smith's hearth, except that in the middle of this was sunk a cup-shaped cavity or crucible, one foot in depth, and half a foot wide, in the upper part of which was made a hole opening into a channel through the brickwork. This hole being closed with clay, the crucible was filled with lighted charcoal, heaped up so as to be above the level of the hearth; a blast of air was then admitted through a pipe, let into the wall in the same manner as a smith's forge, and so contrived that the focus of the blast should be just above the centre of the crucible. Charcoal alone was added from time to time, till the hearth became thoroughly hot, and then, at the discretion of the workmen, the ore, in very small pieces, unroasted, but mixed with unslacked quicklime, was laid on alternately with the charcoal. As soon as it had descended low enough to be within the immediate influence of the blast (which in a furnace of this construction would be in a few minutes), the lime and earthy part of the ore became fused into a slag, and, enveloping the iron now in a metallic state, sunk down into the crucible, displacing the charcoal with which it had been at first charged. The matter remaining at rest in the crucible, gave an opportunity to the particles of iron to sink to the bottom, which they did in greater or less proportion according to the fluidity of the slag, and the completely metallic state of the iron. After this process had been going on for the space of from eight to twelve hours, the crucible became filled with melted metal; at this time the hole, which had been at first stopped up with clay, was opened by means of an iron bar, introduced through the channel in the brickwork, and the scoriæ immediately flowed out, leaving the iron behind, covered with hot charcoal. The blast being stopped, the furnace soon got sufficiently cool to allow the workmen to take out the iron, which was found imperfectly concreted together, in a mass nearly of the shape of a wooden bowl;

this being transferred to an anvil, was first carefully hammered with wooden mallets to break off the incrusting scoriæ, and render it sufficiently compact to bear the tilt hammer, to which it was next subjected. Being then divided into five or six pieces, each was separately forged into a bar, and thus the operation was finished. The iron thus obtained was extremely tough and hard, but difficult to work—was in great request for helmets and other articles of defensive armour—and in general for all purposes where toughness and hardness united were particularly required. The rich quality of the ore, and the circumstances in which it was reduced, were probably the chief causes of the excellence of this kind of iron; a peculiarity, however, in the method of forging it, may also have somewhat contributed to this, for while it was under the tilt hammer, an assistant stood by with a ladle of water, with which he sprinkled the bar as often as it was struck by the hammer.

The poorer ores, which are incapable of being smelted in the above method, were first picked, washed, and roasted, then reduced to pieces no larger than hazle nuts, and reduced (no doubt with the addition of lime) in blast furnaces from seven to eight feet high, and shaped like a chimney. In these a considerably greater heat could be produced than in the former, but it does not appear that the metal, when taken out of the furnace, was in the state of cast-iron; certain it is, that it was always allowed to cool there, and was never run into pigs, as is the modern practice.

Some ores that are very rich, and yield a soft iron, have been occasionally wrought in a manner still more simple than either of the preceding. The rich specular ore of the island of Elba in particular, appears formerly to have been worked to a considerable extent in this, which, if not the earliest, is certainly the rudest method that has hitherto been devised. "The ore being broken into small pieces, is heaped upon a bed of charcoal, in a very simple reverberatory furnace. When the whole has been glowing hot for some time, the pieces being now soft, and at a welding heat, are, by the dexterous management of the workmen, brought in close con-

tact with each other by means of an iron bar; they are then lightly hammered, while still in the furnace, and thus the whole mass acquires sufficient compactness to be removed to the anvil without falling to pieces; it is now hammered with a gradually increasing force, the earthy impurities are thrown off together with the scales of black oxide, the lump is divided into pieces of a convenient size, which by repeated heating and hammering are drawn into bars."

These ancient methods have gone into disuse, not because the quality of the iron thus produced was to be objected to, but because the time and fuel consumed were enormous; and the iron that remained in the scoriæ amounted at least to one-half of the original metallic contents of the ore.

The modern methods of reducing the ores of iron are principally two, depending on the nature of the fuel made use of. In England and Scotland it is for the most part coal, but in the rest of Europe charcoal, with the exception of some of the furnaces in France and the Netherlands.

The best Swedish bar-iron, named "Oregrund iron," from the port whence it is shipped for the English market, is entirely prepared from the magnetic ironstone of Dannemora. The forges and foundries where it is manufactured are those of Soderfors, and other places in the province of Roslagia; and the most approved processes that it undergoes for this purpose are the following:—

The ore, in moderately large pieces, such as it comes from the mine, is first roasted. For this purpose, an oblong coffer of masonry, 18 feet long, 15 feet wide, and about 6 feet in depth, open at top, and furnished with a door at one of its smaller extremities, is entirely filled with logs of wood; over this the ore is piled to the height of from five to seven feet, and is covered with a coating of small charcoal, almost a foot and a half in thickness. Fire is then communicated to the bottom of the pile by means of the door just mentioned, and in a short time the combustion spreads through the whole mass: the small quantity of the pyrites that the ore contains, is decomposed by the volatilisation of the sulphur; the moisture is also driven off, and the ore, from being very hard and

refractory, becomes pretty easily pulverisable. In the space of twenty-four hours the roasting is completed, and the ore, when sufficiently cool, is transferred to a stamping-mill, where it is pounded dry, and afterwards sifted through a network of iron, which will not admit any piece larger than a hazel nut to pass. It is now ready to be smelted.

The smelting furnace is a strong quadrangular pile of masonry, the internal cavity of which, though simple in form, is not very easily described; it may be considered, however, in general, as representing two irregular truncated cones, joined base to base; of these the lower is scarcely more than one-third of the upper, and is pierced by two openings, through the upper of which the blast of wind from the blowing machine is admitted into the furnace; and from the lower the melted matter, both scoriæ and metal, is discharged from time to time at the pleasure of the workmen.

The furnace is first filled with charcoal alone, and well heated; after which, alternate charges are added, of ore, either alone, or mixed with limestone if it requires any flux, and charcoal; the blast is let on, and the metal in the ore being highly carbonised in its passage through the upper part of the furnace, is readily melted as soon as it arrives in the focus of the blast, whence it subsides in a fluid state to the bottom of the furnace, covered with a melted slag. Part of the clay that closes the lower aperture of the furnace is occasionally removed, to allow the scoriæ to flow out, and at the end of every ninth hour the iron itself is discharged into a bed of sand, where it forms from ten to twelve small pigs. As soon as the iron has flowed out, the aperture is closed again, and thus the furnace is kept in incessant activity during the first six months of the year; the other six months are employed in repairing the furnaces, making charcoal, and collecting the requisite provision of wood and ore.

The next process for the conversion of pig into bar-iron, is refining; for this purpose a furnace is made use of, resembling a smith's hearth, with a sloping cavity, sunk from ten to twelve inches below the level of the blastpipe. This cavity is filled with charcoal and scoriæ; and on the side opposite to

the blastpipe is laid a pig of cast-iron, well covered with hot fuel. The blast is then let in, and the pig of iron being placed in the very focus of the heat, soon begins to melt, and, as it liquifies, runs down into the cavity below: here, being out of the direct influence of the blast, it becomes solid, and is then taken out and replaced in its former position—the cavity being then filled with charcoal; it is thus fused a second time, and after that a third time—the whole of these three processes being usually effected in between three and four hours: as soon as the iron has become solid, it is taken out and very slightly hammered, to free it from the adhering scoriæ; it is then returned to the furnace, and placed in a corner, out of the way of the blast, and well covered with charcoal, where it remains, till, by further gradual cooling, it becomes sufficiently compact to bear the tilt hammer. Here it is well beaten till the scoriæ are forced out, and it is then divided into several pieces, which, by a repetition of heating and hammering, are drawn into bars, and in this state is ready for sale. The proportion of pig-iron obtained from a given quantity of ore is subject to considerable variation, from a difference in the metallic contents of different parcels of ore, and other circumstances; but the amount of bar-iron that a given weight of pig metal is expected to yield is regulated very strictly, the workmen being expected to furnish four parts of the former for five parts of the latter, so that the loss does not exceed 20 per cent.

The method of preparing bar-iron in all the other countries of Europe, where charcoal is the fuel made use of, is, upon the whole, very similar to that just detailed, allowing for a few variations, according to the different species of ore that are employed; but, in Great Britain, the number of charcoal furnaces, towards the end of the last century, were trifling compared with those where coke was used, and the adoption of this kind of fuel led, by necessity, to a method of manufacturing iron quite peculiar to this country, and wholly inapplicable to those establishments that are carried on by means of charcoal.

The first step in the process, after the iron was run from

the furnace, was refining. For this purpose the pigs were smelted in a refinery (the construction of which has been already noticed) by means of charcoal, which was still used in the refinery; and as soon as the metal was in fusion, it was let out into a mould of sand, to separate the scoriæ that rise to its surface, and in this state was called a half-bloom. As soon as it became solid, it was again transferred to the furnace, and treated as before; sometimes even a third fusion was required before the iron showed sufficient malleability to clot into lumps when beaten down, almost at a fusing heat, by an iron bar. When it had acquired this consistency, it was taken out in moderate-sized pieces, which, being placed under the great forge, or shingling hammer, was speedily stamped into cakes, about an inch thick; several piles of these cakes, about a foot high, were then laid on flat circular stones, and placed on the balling or reverberatory furnace, where they were strongly heated. As soon as the whole acquired a pasty state, one of the piles was taken out by a workman, and drawn under the hammer into a short bar, which, being finished, was applied to another of the piles, to which it soon adhered; and, being then withdrawn, the new portion was welded firmly to the first, by means of the hammer, and thus the bar was doubled in length; by repeating the same simple and ingenious operation, the bar was made as long as its weight would conveniently allow. The cracks in the bar were then closed, and its tenacity was improved by heating it afresh in a fire, made of coal, called the chaffery, and again subjecting it to the action of the forge hammer. It was now in the state of common bar iron, and ought to be entirely free from all earthy particles. After this, according to the use for which it was intended, it was transferred to the slitting mill, where it was laminated, and cut up into bars and rods, of various dimensions, by which its toughness and compactness was much improved, and was then ready for the smith. The above method was called stamping; but, besides this, there was another, called flourishing, which requires a short notice. In this the pigs of cast-iron, when put into the refinery, were kept for about two hours and a half in a pasty state, without

actually melting; and at the end of this period the metal was taken out by shovels, and laid on the open floor, on a plate of cast-iron, where it was beaten with hand hammers, in order to knock off the cinders, and other adhering impurities. It was afterwards placed under the forge hammer and beaten—at first gently, till the whole mass had acquired some tenacity, and then the middle part was drawn into a bar four feet long, terminated at each extremity by a cubical lump of rough iron—in this state it was called an ancony. It was then taken to the chaffery, hammered afresh, and the ends being also drawn down to the same dimensions as the other part, the bar was completed.

A considerable waste of iron was, in these various processes, sustained, amounting to 10 or 12 cwt. for every ton of bars that were finished; but the difference of the price of fuel compensated for this additional loss, and the necessity of the case, from the diminution of wood, and increased demand, had become imperious.

The manufacture of bar-iron remained subject to the stamping process many years, and the quality of the iron so made was strong and generally tough, but the tardy finish of the hammer, and the arrangement of the whole, was not calculated speedily to overcome quantity, and it was considered a respectable establishment that could turn out, in one week, twenty tons of bars fit for the market.

Refineries could not be multiplied without an additional increase of blast, and this in general could not be done without additional steam-engines, and the manufacture had become apparently stationary, when the discoveries of Mr. Cort furnished the iron masters with a new and interesting field for enterprise.

The object of Mr. Cort's processes was to convert into malleable iron, cast or pig-iron, by means of the flame of pit-coal, in a common air furnace, and to form the result into bars, by the use of rollers in the place of hammers. The process was managed in the following manner:—

"The pigs of cast-iron produced by the smelting furnace are broken into pieces, and are mixed in such proportions,

according to their degree of carbonization, that the result of the whole shall be a grey metal. This mixture is then speedily run in a blast furnace, where it remains a sufficient time to allow the greater part of the scoriæ to rise to the surface. The furnace is now tapped, and the metal runs into moulds of sand, by which it is formed into pigs, about half the size of those which are broken into pieces. A common reverberatory furnace, heated by coal, is now charged with about 2½ cwt. of this half-refined grey iron. In a little more than half an hour, the metal will be found to be nearly melted; at this period the flame is turned off, a little water is sprinkled over it, and a workman, by introducing an iron bar, or an instrument shaped like a hoe, through a hole in the side of the furnace, begins to stir the half fluid mass, and divide it into small pieces. In the course of about fifty minutes from the commencement of the process, the iron will have been reduced, by constant stirring, to the consistence of small gravel, and will be considerably cooled. The flame is then turned on again, the workman continuing to stir the metal, and in three minutes' time the whole mass becomes soft and semi-fluid, upon which the flame is again turned off. The hottest part of the iron now begins to heave and swell, and emit a deep-blue lambent flame—which appearance is called fermentation; the heaving motion and accompanying flame soon spread over the whole, and the heat of the metal seems to be rather increased than diminished for the next quarter of an hour; after this period the temperature again falls, the blue flame is less vigorous, and, in a little more than a quarter of an hour, the metal is cooled to a dull red, and the jets of flame are rare and faint. During the whole of the fermentation the stirring is continued, by which the iron is at length brought to the consistency of sand; it also approaches nearer to the malleable state, and, in consequence, adheres less than at first to the tool with which it is stirred. During the next half hour the flame is turned off and on several times, a stronger fermentation takes place; the lambent flame also becomes of a clearer and lighter blue—the metal begins to clot, and becomes much less fusible, and more tenacious than at first—the

fermentation, then, by degrees, subsides—the emission of blue flame nearly ceases—the iron is gathered into lumps, and beaten with a heavy-headed tool. Finally, the tools are withdrawn—the apertures through which they were worked are closed—and the flame is again turned on in full force for six or eight minutes. The pieces being thus brought to a high welding heat, are withdrawn and shingled; after this, they are again heated, and passed through grooved rollers, by which the scoriæ are separated, and the bars thus forcibly compressed acquire a high degree of tenacity."*

Mr. Cort made many experiments in the progress of establishing his inventions; but, so long as the various quantities of pig-iron only were the subject of operation, the results in the puddling furnace, his invention, were uncertain, attended with waste, and unequal in quality.

These obstacles were at length removed by the introduction of the coke refinery. The idea of melting the pig-iron in fineries with coke, occurred to, and was put into operation by, the late Mr. Samuel Homfray, at Penydarran. This succeeding, the puddling and balling furnaces came immediately into action, and both into general use, with the addition of the use of rollers in lieu of hammers.

Neither Mr. Cort nor his family, however, derived any advantage from these most important and valuable discoveries, which have given to this country the command of the markets of the world. In the year 1812, Mr. Coningsby Cort, after the death of his father, presented a petition to

* Mr. Eaton, in his "Survey of the Turkish Empire," states the following circumstance as having occurred to his own knowledge:—An Arabian of Constantinople had discovered the secret of casting iron, which, when it came out of the mould, was as malleable as hammered iron. Some of his fabrication was accidentally shown to M. de Gaffron, the Prussian Chargé d'Affaires, and M. Franzaroli (men of mineralogical science), who were struck with the fact, and immediately instituted an inquiry for its author. This man, whose art in Christendom would have ensured him a splendid fortune, had died poor and unknown, and his secret had perished with him. His utensils were found, and several pieces of his casting, all perfectly malleable! M. Franzaroli analyzed them, and found that there was no admixture of any other metal. M. de Gaffron has since been made superintendent of the iron manufactory at Spandau, where he in vain attempted to discover the process of the Arabian.

the House of Commons. Mr. Manners Sutton, by command of his Royal Highness the Prince Regent, acquainted the House that his Royal Highness having been informed of the contents of the said petition, recommends it to the consideration of the House.

The petition set forth "that, in the years 1783 and 1784, two respective patents were granted by his present Majesty to the petitioner's late father; the one for a new and improved method of making iron in a reverberatory, or air furnace, heated by common raw pit-coal; and the other for manufacturing the iron, when malleable, into bars, bolts, and a variety of other uses, by passing it in a welding heat through rollers, with grooves accurately formed, instead of working it under forge hammers—a process never before adopted or brought to perfection, and now in general use; and that the petitioner's father expended the whole of his private fortune in bringing the said discoveries to perfection, and in endeavouring to establish the means of availing himself of the benefits of his patents; and that various unforeseen misfortunes, arising from the failure of the funds of the petitioner's father, prevented him reaping the benefit of his discoveries, and in the meantime the period of his patents expired, and the process had come into general use, and the petitioner's father was wholly deprived of the means of participating in the benefits of his discoveries—so valuable to the public, and advantageous to all those engaged in the trade; and that the patent method is not only generally adopted throughout Great Britain, but, from its immense and progressive increase of late years, has been the means of rendering the nation, in this most important branch of commerce, independent of all foreign countries, whereby very large sums, formerly paid to Russia and Sweden at their ports of exportation, and which, from the late vast augmentation of demand in this article of trade, would be greatly increased, are saved; and iron is now made in this country fit for the use of his Majesty's navy, equal in body, strength, and toughness, to the first sort of Swedish ore-ground iron, and at a much cheaper rate than it could be obtained by importa-

tion; and that it is now computed, and admitted by the trade, that there is about 250,000 tons of wrought-iron manufactured according to the principles of the patent method of the petitioner's father: and that about 150,000 tons of iron, part of the above quantity, are rolled into bars, upon the exact and precise principle laid down in the specification of the patents granted to the petitioner's father, without any practical deviation whatever."

This petition was referred to a committee, and was opposed by some of the iron masters, who produced evidence to prove that the iron manufactured, according to Mr. Cort's process of puddling, was of very inferior quality. The committee reported upon the petition, and an estimate of the sum wanted for carrying into effect the resolutions of the committee, amounting to 250*l.*, was some time afterwards laid before the House, and here the matter rested.

To give some idea of the importance of Mr. Cort's invention of the rollers, it may be as well here to mention that, previous to their introduction, the smallest size drawn under the hammer was three-quarters square; all below that size were cut in the splitting-mill,* and it required the hammer to

* The most extraordinary and the best attested instance of enthusiasm, existing in conjunction with perseverance, is related of the founder of the Foley family. This man, who was a fiddler, living near Stourbridge, was often witness of the immense labour and loss of time caused by dividing the rods of iron, necessary in the process of making nails. The discovery of the process called splitting, in works called splitting-mills, was first made in Sweden, and the consequences of this advance in art were most disastrous to the manufacturers of iron about Stourbridge. Foley, the fiddler, was shortly missed from his accustomed rounds, and was not again seen for many years. He had mentally resolved to ascertain by what means the process of splitting of bars of iron was accomplished; and, without communicating his intention to a single human being, he proceeded to Hull, and thence, without funds, worked his passage to the Swedish iron port. Arrived in Sweden, he begged and fiddled his way to the iron founderies, where, after a long time, he became a universal favourite with the workmen; and, from the apparent entire absence of intelligence, or any thing like ultimate object, he was received into the works, to every part of which he had access. He took the advantage thus offered, and having stored his memory with observations and all the combinations, he disappeared from amongst his kind friends as he had appeared—no one knew whence or whither. On his return to England he communicated his voyage and its results to Mr. Knight and another person in the neighbourhood, with whom he was associated, and by whom the necessary buildings were erected and machinery pro-

be kept constantly at work to draw 20 cwt. of average sizes in twelve hours, while, with the rollers they can manufacture, in the same time, with one pair of rollers, about 15 tons, which, in a work in full operation, are kept constantly employed, day and night, during six days of the week. Of the small sizes they roll about five tons in the twelve hours.

The iron trade continued rapidly to increase, and as the great addition was principally in Wales, where the manufacture, as compared with Shropshire and Staffordshire, may be considered as of modern growth, we will shortly refer to the origin of the trade in that part of the country.

About the year 1755, Merthyr Tydvil, then an inconsiderable village, attracted the notice of Mr. Anthony Bacon, on account of the iron and coal mines with which this tract of country abounds. For the low rent of 200*l.* per annum, he obtained a lease, of ninety-nine years, of a district, eight miles in length by five in breadth, upon which he erected iron and coal works. At the beginning of the American war, Mr. Bacon contracted with government for casting cannon. Proper furnaces were erected for this purpose, and a good turnpike-road was made down to the port of Cardiff, along an extent of twenty-six miles. At Cardiff likewise a wharf was formed, still called the Cannon Wharf, whence the cannon were shipped off to Plymouth, Portsmouth, and wherever the service required. The cannon were carried in waggons down

vided. When at length every thing was prepared, it was found that the machinery would not act; at all events, it did not answer the sole end of its erection—it would not split the bar of iron. Foley disappeared again, and it was concluded that shame and mortification at his failure had driven him away for ever. Not so: again, though somewhat more speedily, he found his way to the Swedish iron works, where he was received most joyfully, and, to make sure of their fiddler, he was lodged in the splitting-mill itself. Here was the very end and aim of his life attained beyond his utmost hope. He examined the works, and very soon discovered the cause of his failure. He now made drawings, or rude tracings; and having abided an ample time to verify his observations, and to impress them clearly and vividly on his mind, he made his way to the port, and once more returned to England. This time he was completely successful, and, by the results of his experience, enriched himself and greatly benefited his countrymen. This I hold to be the most extraordinary instance of credible devotion in modern times.—*Letters, Conversations, and Recollections of S. T. Coleridge, Esq.*

to Cardiff, at a great expense of carriages, horses, and roads.

This contract is supposed to have been very lucrative to Mr. Bacon, but he was obliged to relinquish it about the close of the American war, or rather to transfer it to the Carron Company, in Scotland, where most of the cannon are still cast. He made this disposal that he might be enabled to hold a seat in Parliament, to which he had been elected. Soon afterwards, about the year 1783, having accumulated a splendid fortune, he disposed of his mineral kingdom, by leases, to different parties, and in lots:—the Cyfartha works, the largest portion, to Mr. Crawshay; Penydarran, to Mr. Homfray; Dowlais, to Messrs. Lewis and Tate; and a fourth part (the Plymouth works) to Mr. Hill.

Mr. Malkin, in his "Antiquities of South Wales," published in the year 1803, says—"Mr. Crawshay's Iron Works, of Cyfartha, are now by far the largest in this kingdom. He employs constantly upwards of 2000 men. He makes, upon an average, between sixty and seventy tons of bar-iron every week, and has lately erected two new additional furnaces, which will soon begin to work, when he will be able to make, one week with another, 100 tons of bar-iron. Mr. Homfray makes weekly, on a moderate average, fifty tons of bar-iron and upwards, and is now extending Penydarran and its buildings, which will soon be completed; he will then make at least eighty tons per week. Dowlais Iron Works, belonging to Messrs. Lewis and Tate, are on as large a scale as those of Penydarran, and about to be augmented in an equal proportion. Those of Mr. Hill make thirty tons of iron weekly and upwards; additional buildings are now erecting, which, when finished, will make at least forty tons per week. At present more than 200 tons of iron are sent down the canal weekly to the port of Cardiff, whence it is shipped off to Bristol, London, Plymouth, Portsmouth, and other places, and a considerable quantity to America. "It is supposed that, in the course of a year or two, they will be able to send out 300 tons weekly. The number of smelting furnaces at Merthyr Tydvil is about sixteen. Six of these belong to

Cyfartha works, the rest to the other gentlemen who have been named. Around each of these furnaces are erected forges and rolling-mills, for converting pig into plate and bar-iron."

Great as this increase may appear, as compared with the whole manufacture of Great Britain a few years previously, yet how small as compared with the increase which shortly took place, as will appear by the following account of the iron sent down the Glamorganshire Canal, from the 1st day of January, 1817, to the 1st day of January, 1831. These returns consist almost entirely of manufactured iron, but the proportions have not been ascertained :—

	1817.	1818.	1819.	1820.	1821.	1822.	1823.
Cyfartha and Hirwain..	14,191	15,706	16,646	19,010	18,070	17,137	19,452
Dowlais	9,936	9,694	10,796	11,115	12,571	14,557	14,025
Penydarran....	8,275	8,834	7,549	8,690	10,018	9,924	10,240
Plymouth	7,095	7,377	7,633	7,941	9,943	8,833	10,920
Aberdare......	..	..	..	2,626	1,863	2,023	2,659
Total tons..	39,497	41,611	42,624	49,382	52,465	52,474	57,296

	1824.	1825.	1826.	1827.	1828.	1829.	1830.
Cyfartha and Hirwain..	20,399	23,063	20,206	29,312	30,011	24,768	19,892
Dowlais......	12,594	15,851	16,601	20,726	23,575	23,352	27,647
Penydarran....	10,358	10,611	8,691	10,369	10,223	10,085	11,744
Plymouth	9,499	11,269	7,836	12,907	12,976	13,534	12,177
Aberdare	4,234	6,354	6,686	8,472	9,864	8,644	6,765
Brown and Co.	969	1,178	57	1,059	720	767	621
R. Blakemore..	..	..	..	2,101	2,056	2,001	2,702
Gadly's......	..	..	..	..	414	559	..
Bute	..	..	..	..	..	166	..
Total tons..	58,053	68,326	60,077	84,946	89,839	83,876	81,548

The extraordinary increase of the manufacture in the Monmouthshire district is, from its extent, more remarkable than that which has just been described. Mr. Coxe, in his "Historical Tour in Monmouthshire," published in the year 1801, speaking of the abundance of ironstone, coal, and limestone in that county, says—

"The mountainous district which contains these mineral

treasures is held by the Earl of Abergavenny, under a lease from the Crown. It was formerly let to the family of Hanbury, of Pont-y-pool,* for less than 100*l*. a-year; and as the value of the mines was not sufficiently appreciated, no works were constructed, but the masses of ore found near the surface were conveyed to the forges of Pont-y-pool. Soon after the expiration of the term the district was granted, by another lease, to Hill and Co., who began the Blaenavon works in 1788.

"On considering the rise and rapid progress of the iron manufactories in this district, as well as in the neighbouring mountains of Monmouthshire and Glamorganshire, it is a matter of wonder that these mineral treasures should have been so long neglected. This wonder will increase when it is known that iron was manufactured in this country at a period beyond the reach of tradition or history. Large heaps of slag, or cinder, have been repeatedly discovered, some of which are evidently the product of bloomeries—the most ancient method of fusing iron; in other places are traced the sites of furnaces long disused, of which no account of their foundation can be collected. The appearance of these iron cinders, and the vestiges of ancient furnaces, indicate that many parts of this mountainous district, now wholly bare, were formerly covered with large tracts of wood. This conjecture is corroborated by numerous names, alluding to woods and forests, in places which have never been known to produce trees; and is still further ascertained by the discovery of trunks and branches, with their leaves, under the boggy soil, in the vicinity of Blaenavon and on the neighbouring hills.

"The lands being cleared, and the forests neglected, their destruction was hastened by numerous herds of goats, maintained in these mountainous regions; the want of fuel occasioned the gradual decline of the bloomeries and furnaces, and for a considerable period little or no iron was manufactured.

* Capel Hanbury, descended from an ancient house in Worcestershire, is the earliest proprietor on record of the iron works at Pont-y-pool. The earliest conveyance deeds are dated 1565, and a regular account of the sale of iron commences in 1588.—*Williams's History of Monmouthshire.*

"About forty years ago the iron works suddenly revived, from the beneficial discovery of making iron with pit-coal instead of charcoal, which was soon afterwards followed by the improvement of manufacturing even bar-iron by means of pit-coal: hence, a district which contained such extensive mines of ore and coal, prodigious quantities of limestone, and numerous streams of water, could not fail of becoming the seat of many flourishing establishments. Besides these local advantages, the progress of the manufactories has been powerfully aided by the application of mechanics, particularly by the use of the steam-engine, and the great improvement of water machines; but in no instance have they derived more advantage than from the adoption of rollers instead of forge hammers, now used for the formation of bar-iron, with a degree of dispatch, as well as exactness, before unknown. From this concurrence of circumstances, the success has been no less rapid than extraordinary. Fifteen years ago the weekly quantity of pig-iron made in this part of Monmouthshire, and in the contiguous district of Glamorganshire, did not exceed sixty tons; at present it scarcely falls short of 600 tons; at that period no bar-iron was manufactured, but now the quantity amounts weekly to more than 300 tons. The works are still rapidly increasing in extent and importance, and appear likely to surpass the other iron manufactories throughout the kingdom."

This prediction has been fulfilled, as will appear by the following statements, showing the quantities of iron conveyed down the Monmouthshire Canal, from the year 1802 to the 1st Jan. 1831. The first is a statement of the quantity from each work distinguishing thereby the increase in their operations, and also the new works as they were put into blast. The second statement shows the different descriptions of iron which were manufactured at the works.

Years.	Blaen-avon.	Garndyr-ris.	Beaufort.	Clydach.	Ebbw Vale.	Varteg.	Tredegar.	Nant-y-glo.	Coal-brooke Vale.	Blaina.	Pentwyn.	Abersy-chan.	Bute.	Sundry persons.	Total tons.
1802	1091.5	....	....	....	....	....	....	....	....	....	....	....	....	....	1091.5
1803	2079.10	....	1612.5	447.	1655.	81.10	....	....	....	....	....	....	....	2804.13	8679.18
1804	8490.	....	2950.10	1266.5	2890.10	771.	....	....	....	....	....	....	....	4106.10	20474.15
1805	7262.10	....	4605.5	1455.10	1012.15	1094.	956.5	....	....	....	....	....	....	6045.10	22431.15
1806	6594.15	....	3989.10	1599.10	3252.	2482.10	3124.	....	....	....	....	....	....	2952.10	23994.15
1807	6042.	....	3947.10	1196.15	2209.5	2745.5	4138.15	....	....	....	....	....	....	2740.	23019.10
1808	7163.15	....	4004.	963.	1553.	2379.10	5529.10	....	....	....	....	....	....	2959.	24551.15
1809	9848.15	....	3566.5	1136.10	786.10	2053.10	9105.15	....	....	....	....	....	....	3244.	29741.5
1810	12254.	....	3948.5	1372.	2758.5	1676.10	7696.10	....	....	....	....	....	....	4365.5	34070.15
1811	12377.10	....	3910.15	872.10	2633.15	583.	6643.5	77.	....	....	....	....	....	3361.5	30459.
1812	14579.10	....	3995.5	1774.	4648.	120.	7862.	1168.15	....	....	....	....	....	5873.5	40020.15
1813	13562.5	....	3204.7	2174.5	5939.2	141.15	7597.10	1855.	....	....	....	....	....	7348.	41822.4
1814	12438.10	....	3146.10	1472.15	4752.	....	9131.10	2292.15	....	....	....	....	....	8604.10	41838.10
1815	14002.15	....	3767.12	2999.10	4953.3	....	9225.	4684.5	....	....	....	....	....	6574.15	46207.
1816	11773.	....	3164.2	2658.5	2949.9	....	7499.10	6160.5	....	....	....	....	....	4239.4	38443.15
1817	11080.2	2247.2	2104.5	3162.10	3127.5	127.10	10350.6	7242.10	....	....	....	....	....	3966.	43407.10
1818	8771.	5097.10	2100.18	3947.15	2476.12	....	8258.2	7325.10	....	....	....	....	....	4034.19	42012.6
1819	6776.10	4427.	2124.	3788.5	1907.10	225.5	7140.10	7934.15	....	....	....	....	....	3386.	37709.15
1820	9423.10	2798.5	3132.	3397.15	3605.15	360.10	8211.	8826.5	....	....	....	....	....	5707.6	45462.6
1821	8973.15	2838.	2962.10	3876.15	6041.5	3757.	9923.	10460.10	1880.5	....	....	....	....	6577.	57290.
1822	5831.5	3476.	3786.15	4225.10	5960.	4453.10	8102.15	10906.10	919.10	....	....	....	....	4770.5	52432.
1823	10745.	4370.	4269.15	3651.	8613.	5031.15	9903.15	12723.10	1582.	....	....	....	....	5674.10	66564.5
1824	11265.	4517.10	5347.10	3617.5	10101.10	5290.10	11444.15	15134.5	1541.5	212.15	....	....	....	7848.5	76320.10
1825	9043.15	4218.	7091.5	3748.15	10325.15	4512.	11012.10	16536.10	3596.5	1588.10	83.	....	....	7044.5	78800.10
1826	8059.10	2145.10	6028.10	3660.5	10297.10	5128.10	10962.10	11512.	2874.10	2098.10	738.5	....	....	6278.5	69783.15
1827	8255.	2446.5	5914.5	4107.15	14403.10	7427.5	13837.5	18059.10	3016.5	2991.5	4140.10	113.10	....	6906.	91618.5
1828	9766.5	2645.10	5701.5	5183.15	15479.15	8131.	14341.	19032.	3756.	3507.	4147.5	6478.10	6320.15	6428.10	110918.10
1829	10124.	2242.15	6896.15	6967.10	16959.5	9232.10	13349.5	17433.10	1902.5	4863.15	4698.15	7760.10	9909.15	4191.	116531.10
1830	9397.15	3654.15	5065.15	6771.	18133.15	8988.10	12303.5	17115.	1905.5	4195.15	5425.5	7615.15	5728.5	6347.5	112647.5

Years.	Pigs. Tons.	Castings. Tons.	Refined metal. Tons.	Puddled bars and blooms. Tons.	Bars, rods, hoops, &c. Tons.	Total Tons.
1802	985	—	106	—	—	1,091
1803	5,926	393	1,824	536	—	8,680
1804	15,227	519	3,159	1,281	288	20,475
1805	16,431	825	2,166	1,010	2,000	22,432
1806	12,948	486	3,557	1,717	5,286	23,995
1807	13,622	250	1,913	1,328	5,906	23,019
1808	18,134	207	865	747	4,599	24,552
1809	21,703	1,130	1,087	1,087	4,734	29,741
1810	16,623	2,320	1,783	1,143	12,201	34,071
1811	17,512	905	1,656	341	10,045	30,459
1812	19,194	1,512	4,073	472	14,769	40,021
1813	15,098	765	8,637	689	16,632	41,822
1814	13,690	690	10,440	897	16,121	41,838
1815	14,477	876	8,722	778	21,354	46,207
1816	12,148	801	6,467	489	18,539	38,444
1817	11,728	987	4,849	904	24,940	43,407
1818	9,778	849	6,577	2,790	22,018	42,012
1819	6,305	541	5,566	1,258	24,039	37,710
1820	7,026	2,242	3,823	502	31,869	45,462
1821	8,465	1,871	7,119	361	39,474	57,290
1822	5,988	689	3,144	436	42,184	52,432
1823	9,440	511	3,231	542	52,840	66,564
1824	6,066	1,095	4,356	319	64,484	76,320
1825	4,687	977	3,600	292	69,244	78,800
1826	12,729	1,849	3,427	190	51,588	69,784
1827	12,833	3,054	5,444	397	69,889	91,618
1828	26,807	3,087	7,256	531	73,236	110,918
1829	32,629	1,879	5,988	209	75,825	116,531
1830	25,835	1,780	7,910	256	76,865	112,647

In the early part of the year 1825, Mr. Herries, then Chancellor of the Exchequer, on bringing forward the budget, proposed a considerable reduction of the duties on foreign iron — these duties had been gradually rising for some years:—

From 1782 to 1795 the duty on foreign bars was			£2	16	2	per ton.
1796	,,	,,	3	1	9	,,
1797	,,	,,	3	4	7	,,
From 1798 to 1802	,,	,,	3	15	5	,,
1803	,,	,,	4	4	4½	,,
1804	,,	,,	4	17	1	,,
1805	,,	,,	5	1	0	,,

From 1806 to 1808 the duty on foreign bars was			£5	7	5¾	per ton.
1809 to 1812	,,	,,	5	9	10	,,
1813 to 1818	,,	,,	6	9	10	,,
1819 to 1825	,,	,,	6	10	0	,,
if imported in British ships, and			7	18	6	,,

if imported in foreign ships.

The Chancellor of the Exchequer, after showing a prospective surplus revenue, stated the objects he had in view in his intended application of it; the principal of which was, the extension of commerce, by increasing the facility of consumption of foreign produce in this country. "He considered that there were many articles upon which the very high, and, in many cases, the prohibitory duties ought to be withdrawn, but there was one upon which he could not help saying a few words—he meant foreign iron. He hoped that those engaged in the home manufacture would not object to its introduction. Indeed, if they consulted their own interests, they must be aware that such a measure would, in the result, be to their advantage. The price of iron had lately risen to an enormous height, not from any new speculation in that article —not from any belief that the country was to be covered with iron railroads, and that all the iron which could be dug out of the bowels of the earth would be required to supply the demand—but from a general increase of trade, produced by the increased and increasing comforts and prosperity of the people in this and other nations. The fact was, the supply of iron in this country was not at all in proportion to the demand. He knew that there were at the present moment foreign orders in Sheffield and Birmingham which could not be executed, because the manufacturers there could not supply the article at the price which the foreign customers could afford to pay. The consequence was, that several such orders had been withdrawn and sent to other countries, where, though they could not be executed in the same good style, yet, as being much cheaper, they were preferred by those who could not afford the higher price. It was not sound policy in this country to continue restrictions which had the effect of thus crippling a very important branch of her manufacture. He was happy to say, that very many of the iron masters,

whose transactions were most extensive, did not object to the measure which was about to be proposed, of reducing the duty on foreign iron. They were above the narrow and selfish policy of opposing the introduction of a foreign article, which might seem for a moment to come in contact with their own trade, but which, in reality, would be a benefit to them, by giving an increased stimulus to other branches of our domestic manufacture. He thought the interests of the community would be best consulted by reducing the duty from 6*l.* 10*s.* to 1*l.* 10*s.* As the high duty had acted as a kind of prohibitory duty on the importation of foreign iron, the immediate loss to the revenue would not be any thing worth naming; but he was certain that, before the end of the year, it would be found that the low duties would have made a considerable addition to the income from customs. It was to be observed, however, with respect to this particular duty, that the change from the high to the low duty should be effected with caution, and should not be made with respect to all countries at once; and this was his reason—one of the objects which he had in view in removing those high prohibitory duties, was to set to other nations an example of what would, in the end, be for their as well as our interests. Some countries had already shown a disposition to avail themselves of it; but it could not be expected that all countries would at once enter into our feelings on that subject. We ourselves, it should be recollected, were a long time before we got rid of the trammels which fettered our trade in these points. There were, however, some states who were willing to adopt our regulations, and to open their ports to articles of our produce. To these the remission of the heavy duties would, for the present, be confined, and they would find from us a full compensation for the advantages they were thus disposed to give. But to those nations who were still so far behind in a practical application of commercial knowledge—to those who continued to heap restriction upon restriction, it was not to be expected that we should grant advantages which they withheld from us. Still he had every reason to hope that the exclusion of those states from the benefits of a more enlightened commercial policy would be but temporary, and that, before long, all

nations would see the propriety of imitating an example which must, in the end, be for their advantage. He had no doubt that our example would, in the end, produce general imitation, provided that we did not alter our policy—that we did not undo in one year the good which we had effected in another."

This proposed reduction of duty met with opposition from some of the iron masters, and a petition was presented to the House against it. This petition, however, did not receive much support, and the only iron master who was a member of the House, Mr. Alderman Thompson, expressed himself as favourable to the measure; and although he did not anticipate so great a reduction, yet he, who was largely interested in the trade, was not afraid of the foreign competition. He was an advocate of liberal commercial principles.

Mr. Huskisson, President of the Board of Trade, proposed the resolutions for an alteration in the duties, of which the following relate to iron and steel:—

	Present duty.			Proposed duty.		
IRON, viz.—In bars or unwrought, the produce of any British possession, and imported from thence, per ton	£1	2	2	£0	2	6
In bars, or unwrought, the produce of any other country, per ton	6	10	0	1	10	0
Slit or hammered into rods, and iron drawn or hammered, less than three-quarters of an inch square, per cwt.	1	0	0	0	5	0
Cast, for every 100*l.* of the value	20	0	0	10	0	0
Old, broken and old cast-iron, per ton	0	17	6	0	12	0
Ore, per ton	0	8	9	0	5	0
Pig, per ton	0	17	6	0	10	0
Pig, the produce of and imported from, any British possession in America, per ton	0	8	0	0	1	3
Wrought, not otherwise enumerated or described, for every 100*l.* of the value	50	0	0	20	0	0
Wire, not otherwise enumerated or described, per cwt.	5	18	9	1	0	0
Hoops, per cwt.	1	3	9	1	3	9
STEEL.—Or any manufacture of steel, not otherwise enumerated or described, for every 100*l.* of the value	50	0	0	20	0	0

without discrimination of ships.

These resolutions were agreed to and subsequently embodied in The General Customs Act of the 6th Geo. IV. c. 3., which took effect on the 5th January, 1826.

At the request of Government, a comparative statement was prepared by Mr. F. Finch, of the quantity of pig-iron made in Great Britain in 1823 and 1830. This statement shows the number of furnaces at these dates, and the number erected in each intermediate year. Mr. Poulett Thomson, in his speech on Navigation Laws and Commercial Policy, May, 1832, referred to this great increase in the manufacture of iron.

COMPARATIVE STATEMENT.

SHROPSHIRE.

FURNACES.	1823.		Erected in the years							1830.	
	Total No.	Quantity made.	1824	1825	1826	1827	1828	1829	1830	Total No.	Quantity made.
		Tons.									Tons.
Broseley	2	..	..	..	..	..	..	..	..	2	270
Barnett Leasow	2	2755	..	..	..	..	..	..	..	2	1316
Benthall	1	..	..	..	..	..	..	..	..	1	..
Calcutts	2	1833	..	..	..	..	..	..	..	2	..
Coalbrooke Dale	2	..	..	..	..	..	..	..	..	2	..
Dawley Castle	2	4925	..	..	..	..	..	..	..	2	4312
Donnington	3	8074	..	..	..	..	2	..	..	5	15110
Horsehay	3	4854	..	..	..	..	..	..	..	3	6833
Hadley	2	2080	..	..	..	..	..	..	..	2	—
Kitley	3	4984	..	..	..	..	..	..	..	3	5763
Lightmoor	3	6052	..	..	..	..	..	..	..	3	6194
Madeley Wood	3	2475	..	..	..	..	..	..	..	3	3471
Old Park	4	6900	..	..	..	..	..	..	..	4	15300
Snedshill	2	2786	..	..	..	..	..	..	..	2	317
Wombridge	2	5084	1	..	..	..	..	..	..	3	7134
Wrockwardine	2	5121	..	..	..	..	..	..	..	2	..
Stirchley	..	..	..	..	..	4	..	..	..	*4	..
Lawley	..	..	1	..	..	..	..	..	..	1	3073
Langley	..	..	1	..	1	..	..	..	..	2	4325
Total..	38	57,923	3	—	1	4	2	—	—	48	73,418

The two at Donnington built in lieu of the two at Wrockwardine, which are blown out. Erected in 1832, Madeley 1.—The increase in the quantity made in the year 1830 upon the quantity made in the year 1823, is 26 per cent.

* The quantity made in 1830 is included in Old Park return.

YORKSHIRE.

FURNACES.	1823. Total No.		1823. Quantity.		1830. Total No.		1830. Quantity.
			Tons.				Tons.
Bowling	3	..	5366	..	3	..	5117
Brierley	1	..	2450	..	2*	..	4590
Chapel Town	1	..	1400	..	1	..	1631
Elsicar	3	..	1400	..	3	..	1460
Field Head†	—	..	—	..	—	..	—
Holmes	3	..	2000	..	3	..	1000
Low Moor	4	..	6200	..	4	..	—
Shelf	3	..	—	..	3	..	7480
Milton	2	..	2187	..	2	..	1715
Merfield†	—	..	—	..	—	..	—
Swallow Wood†	—	..	—	..	—	..	—
Sheffield Park	2	..	2018	..	2	..	2081
Thorncliffe	3	..	2909	..	3	..	2188
Worsborough	1	..	1381	..	1	..	1664‡
Total..	26		27,311		27		28,926

The increase of the quantity made in the year 1830, upon the quantity made in the year 1823, is 5 per cent.

* Erected in 1824—Brierley, 1.
† These furnaces have not been worked for several years.
‡ This quantity is estimated.

Furnaces.	1823. Total No.	1823. Quantity made.	Erected in the years 1824	1825	1826	1827	1828	1829	1830	1830. Total No.	1830. Quantity made.
		Tons.									Tons.
Bradley	2	4195	..	..	..	..	..	..	..	2	4194
Ditto Lower....	1	1920	..	..	..	..	..	..	..	1	2113
Birch-hills	2	..	..	..	..	..	..	..	..	2	..
Barber's-field ..	..	..	..	..	1	..	1	..	..	2	5720
Bilston	4	7696	..	..	..	..	..	..	..	4	4680
Bilston-brook ..	2	4345	..	..	..	..	..	..	..	2	3771
Broadwaters....	2	..	..	..	..	..	..	..	..	2	6368
Brettell-lane ..	..	..	..	2	..	..	..	..	..	2	2949
Brierley-hill....	2	4348	..	..	..	..	..	..	..	2	..
Brierley	1	..	..	..	..	..	..	..	..	1	..
Blower's-green..	2	5348	..	..	..	..	..	..	..	2	5257
Buffery........	3	6551	..	..	..	..	..	..	..	3	5246
Buffery, Old ..	1	2646	..	..	..	..	..	..	..	1	2158
Cotham	2	..	..	..	..	..	..	..	..	2	..
Coseley	2	5200	..	..	1	..	..	..	..	3	10140
Capon-field	2	..	..	..	..	..	..	..	..	2	..
Chillington	..	..	..	..	..	..	..	2	..	2	6240
Corbyn's-hall ..	..	..	..	3	..	..	..	1	..	4	7350
Dudley-port....	1	2340	..	..	..	..	..	..	..	1	2340
Ditto	..	..	2	..	..	..	..	..	..	2	4060
Deepfield	2	..	..	..	..	..	..	..	..	2	..
Deepdale	1	2084	..	..	..	..	..	..	..	1	1634
Dudley Wood ..	4	10467	..	..	..	..	..	..	..	4	8664
Eagle	2	4900	..	..	..	..	..	..	..	2	6656
Fiery Holes	1	..	..	..	..	..	..	..	..	1	1634
Glebe	1	..	..	..	..	..	..	..	..	1	..
Gospel Oak	2	5312	..	..	..	2	..	..	..	4	6840
Gold's-green ..	2	4888	..	1	..	..	..	..	..	3	9412
Grave-yard	1	..	..	..	..	..	..	..	..	1	..
Gorwall Wood..	1	1671	..	..	..	..	..	..	..	1	..
Horseley	2	4308	..	..	..	..	..	..	..	2	4680
Hall-fields	1	2454	..	..	..	..	..	..	..	1	2454
High-fields	2	..	..	..	..	..	..	..	..	2	..
Lea-brook	1	..	..	..	..	..	..	..	..	1	..
Leys..........	..	..	..	..	..	..	2	..	..	2	4160
Level	4	6464	..	..	..	..	..	..	..	4	..
Ditto, Old	1	2072	..	..	..	..	..	..	..	1	1028
Mill-fields	4	6768	..	..	..	..	..	..	..	4	8112
Moor Croft	2	3700	..	..	..	..	..	..	..	2	4791
Netherton	2	1406	..	..	..	..	..	..	..	2	5033
Oldbury	2	2600	..	..	..	..	..	..	..	2	5720
Old Park	1	2600	..	..	..	..	1	..	..	2	5280
Priestfield	3	3664	..	..	..	..	..	..	..	3	4897
Parkfield	..	..	..	..	2	1	1	..	..	4	9500
Parkhead	1	2289	..	..	..	..	..	..	..	1	2468
Rough-hills	2	..	..	..	..	..	..	..	..	2	..
Russell's-hall ..	..	..	..	..	..	2	..	..	..	2	2080
Stow-heath	..	..	..	2	1	..	..	..	..	3	5408
Toll-end	3	5075	..	..	..	..	..	..	..	3	6112
Tipton Company.	3	5640	..	..	..	..	..	..	..	3	3515
Tipton	1	2040	..	..	..	..	..	..	..	1	2040
Union	..	..	..	..	..	..	2	..	..	2	4650
Wednesbury Oak	2	6240	1	..	..	..	..	..	..	3	7684
Willingsworth ..	..	..	..	..	..	2	1	..	..	3	5704
Wolverhampton.	..	..	..	1	..	1	..	..	..	2	3200
Wallbrook	1	2359	..	1	..	..	..	..	..	2	2886
Windmill End..	..	..	..	2	..	..	..	..	..	2	3776
Total	84	133,590	3	12	5	6	10	3		123	212,604

The increase of the quantity made in 1830 upon that in 1823, is 58 per cent.
Erected in the year 1831—Leys, 1; Shutend 2.——1832—Bentley 2.

SOUTH WALES.

Furnaces.	1823. Total No.	1823. Quantity made.	Erected in the years 1824	1825	1826	1827	1828	1829	1830	1830. Total No.	1830. Quantity made.
		Tons.									Tons.
Abersychan	..	..	..	..	6	..	..	..	..	6	10640
Aberdare .... } Abernant .... }	3 3	5676	..	..	..	..	..	..	..	6	12571
Blaenafon......	5	16882	..	..	..	..	..	..	..	5	13843
Beaufort	3	5243	1	..	..	..	..	..	..	4	7276
Blaina	..	..	3	..	..	..	..	..	..	3	4905
Coalbrooke Vale	1	2704	1	..	..	..	..	..	..	2	2780
Cefw Cruhur ..	..	..	1	..	..	..	..	..	..	1	..
Cyfarthfa	8	24200	1	..	..	..	..	..	..	9	29000
Clydach	2	5200	..	..	1	..	..	..	..	3	10190
Dowlais	8	22287	..	3	..	..	1	..	..	12	32611
Gadlys	..	..	..	..	..	..	1	..	..	1	..
Hirwen........	2	4160	2	..	..	..	..	..	..	4	9360
Maesteg	..	..	..	..	..	..	1	..	..	1	2430
Nant-y-glo	5	17750	..	..	1	1	..	..	..	7	23883
Pentwyn	..	..	..	3	..	..	..	..	..	3	5391
Pontabydy Ven .	..	..	..	..	2	..	..	..	..	2	..
Pentyech	1	1235	..	..	..	..	..	..	..	1	2412
Plymouth	3	6387	..	1	..	1	..	..	..	5	18582
Penydarran	5	15547	..	..	..	..	..	..	..	5	17015
Romney and Bute	3	5500	..	..	3	..	..	..	..	6	7608
Race	3	3173	..	..	..	..	..	..	..	3	2421
Ryddry	..	..	..	..	..	..	1	..	..	1	220
Sirhowey and } Ebbw Vale }	6	20425	..	..	..	..	..	..	..	6	26020
Tredegar	5	16385	..	..	..	..	..	..	..	5	18514
Varteg hill	2	6513	1	..	1	..	..	..	1	5	13536
Vig. & Smith's, } Cwm Avon }	1	1560	..	..	..	..	..	..	..	1	1950
Yniscedwyn	1	1498	..	..	..	..	..	..	1	2	2111
Neath Abbey ..	2	..	..	..	..	..	..	..	..	2	2374
Pembray	..	..	2	..	..	..	..	..	..	2	..
Total..	72	182,325	12	7	14	2	4	..	2	113	277,643

The increase of the quantity made in the year 1830 upon the quantity made in the year 1823, is 52 per cent.

Erected in the year 1831—Sirhowey, 1; Maesteg, 1.

DERBYSHIRE.

	1823. Total No.		1823. Quantity.		1830. Total No.		1830. Quantity.
			Tons.				Tons.
Alfreton..........	2	..	2690	..	2	..	2950
Brampton	2	..	1807	..	2	..	1245
Butterley	3	..	2639	..	3	..	3981
Calow	1	..	..	..	1	..	123
Codnor Park	2	..	2096	..	3*	..	2455
Duckmanton	1	..	1091	..	1	..	1446
Grassmore†	..	..	..	..	..	..	..
Morley Park	1	..	544	..	2*	..	1428
Renishaw	2	..	2120	..	2	..	2810
Staveley..........	1	..	1051	..	2*	..	1561
Total..	15		14,038		18		17,999

The increase of the quantity made in the year 1830 upon the quantity made in the year 1823, is 28 per cent.

* Erected in the year 1825—Morley Park, 1; Staveley, 1.——1828—Codnor Park, 1.

† Has not been in blast for many years.

NORTHUMBERLAND AND DURHAM.

Furnaces	1823. Total No.	1823. Quantity. Tons.	1830. Total No.	1830. Quantity. Tons.
Birtley	..	..	2*	3080
Lemmington	2	2379	2	2247
Total..	2	2379	4	5327

The increase of the quantity made in the year 1830 upon the quantity made in the year 1823, is 123 per cent.

* Erected in the year 1829—Birtley, 2.

BLAST FURNACES IN SCOTLAND.

Names of Works.	1823.		Erected in the years							1830.	
	Total No.	Quantity made.	1824	1825	1826	1827	1828	1829	1830	Total No.	Quantity made.
		Tons.									Tons.
Clyde	3	2500	..	..	..	..	1	..	..	4	8000
Calder	3	4000	1	..	..	..	..	..	..	4	9000
Monkland	..	..	..	..	1	..	..	1	..	2	2000
Muirkirk	3	3500	..	..	..	..	..	..	..	3	4000
Gartsherry	..	..	..	..	..	..	..	1	..	1	..
Shotts	1	2000	..	..	..	..	..	..	..	1	2000
Carron	5	7000	..	..	..	..	..	..	..	5	7000
Devon	3	3000	..	..	..	..	..	..	..	3	3500
Wilsontown	2	..	..	..	..	..	..	..	..	2	2000
Omoa	2	2500	..	..	..	..	..	..	..	2	..
Total..	22	24,500	1	..	1	..	1	2	..	27	37,500

TOTALS BROUGHT TOGETHER.

Counties.	1823.		Erected in the years							1830.	
	Total No.	Quantity made.	1824	1825	1826	1827	1828	1829	1830	Total No.	Quantity made.
		Tons.									Tons.
South Wales	72	182325	12	7	14	2	4	..	2	113	277643
Staffordshire	84	133590	3	12	5	6	10	3	..	123	212604
Shropshire	38	57923	3	..	1	4	2	..	..	48	73418
Yorkshire	26	27311	..	1	..	..	..	..	..	27	28926
Derbyshire	15	14038	..	2	..	..	1	..	..	18	17999
Northumberland and Durham	2	2379	..	..	..	..	..	2	..	4	5327
Total..	237	417566	18	22	20	12	17	5	2	333	615917

The increase in the quantity made in the year 1830 upon the quantity made in the year 1823, is 47½ per cent.

This account of the make of iron we adopt in preference to other statements made about the same time, knowing the pains that were taken to obtain an accurate return. It is, however, defective, in the omission of the North Wales furnaces; and though it shows the number of furnaces belonging to each work, it does not show the number in blast, so that an average may be taken of the annual make of a furnace.

From various statements we find that, in

1825, the make of pig-iron in North Wales was				..	13,100 tons.
1826	do.	do.	do.	..	15,756
1828	do.	do.	do.	..	25,168
1830 the make may be taken at about the same, say					25,000

The make will then be, in 1830:—

England and South Wales	615,917 tons.
North Wales	25,000
Scotland	37,500
Total	678,417

By the same returns we also find that, in 1825, there were 364 furnaces, of which 261 were in blast, and 103 out—make 581,367 tons.

In 1828—367 furnaces, 277 in blast and 90 out—make 703,184 tons.

In 1825, average per furnace		....	2228 tons.
1828	do. do.	....	2530

The following statement will show the quantities of pig iron made in England, Wales, and Scotland, and also the increased make, at different periods, from the year 1740 to the year 1830:—

Years.		Tons.					Tons.
1740	......	17,350					
1788	......	68,300	—	48	years—increase		50,950
1796	......	125,079	—	8	do.	do.	56,779
				56			107,729
1806	......	258,206	—	10	do.	do.	133,127
				66			240,856
1823	......	452,066*	—	17	do.	do.	193,860
				83			434,716

* Taking North Wales at 10,000 tons.

1825	......	581,367 —	2	years—increase	129,301
			85		564,017
1828	......	703,184 —	3	do. do.	121,817
			88		685,834
1830	......	678,417 —	2	do. decrease	24,767
			90		661,067

Making the total ~~annual~~ increase at this period, as compared with that of 1740—661,067 tons.

CHAPTER VII.

SPAIN.

PRIOR to the further consideration of the home trade, we will, in pursuance of the original intention, give some account of the iron trade in foreign countries; and, although the manufacture in Spain cannot be considered as a matter of any great importance in itself, we will, nevertheless, devote to it a small space in this work.

The darkness which obscures the history of the Spanish population before the settlement of the Celts, 1649 B.C., it is not the province of this treatise to discuss. The people were called Celtiberians after they had united in friendly intercourse and family compacts with the Celts or Gauls then located west of the Ebro. The indefatigable Phenicians traded with Spain at a very early period; they established colonies and built Gades, their emporium of traffic. The contests between them, their Carthaginian allies, and the Spaniards, induced the Saguntines, B. C. 216, to call in the aid of the Romans, who eventually conquered all the country and converted it into one of the richest provinces of their empire. This was not until they had warred with the Spaniards nearly 200 years, during which time mining was extensively practised, and long anterior, for it is well known that the Spaniards had, at a very early period, acquired a considerable knowledge of mining in general;* and, in the time of the

* *Pumps used in the Silver Mines in Spain.*—Sometimes, at a great depth, they meet with rivers under ground, but by art give a check to the violence of their current, for, by cutting of trenches under ground, they divert the stream, and being sure to gain what they aim at, when they have begun they never leave till they have finished it; and to admiration they pump out these floods of water with those instruments called Ægyptian pumps (Ægyptian *cochleans*), invented by Archimedes, of

Romans, they had arrived at a great degree of perfection in the manufacture of arms. An ancient writer * tells us—" The Celtiberians carry two-edged swords, exactly tempered with steel; and they have daggers besides, of a span long, which they make use of in close fights. They make weapons and darts in an admirable manner, for they bury plates of iron so long under ground, until the rust hath consumed the weaker part, and so the rest becomes more strong and firm; of this they make their swords and other warlike weapons, and with these arms, thus tempered, they so cut through every thing in their way, that neither shield, helmet, nor bone can withstand them.† The military arms of the Celtiberians were early adopted by their conquerors.

Syracuse, when he was in Egypt. By these, with constant pumping by turns, they threw up the water to the mouth of the pit, and by this means drain the mine dry, and make the place fit for their work; for this engine is so ingeniously contrived, that a vast quantity of water is strangely, with little labour, cast out, and the whole flux is thrown up from the bottom to the surface of the earth.—*Diodorus—G. Booth's Translation*, p. 192.

* Diodorus.

IMPROVEMENT OF IRON AND STEEL BY THEIR BEING BURIED IN THE EARTH.

† The following is an extract from the "Chronicles of Old London Bridge"—1833:—

"An eminent London cutler (Mr. Weiss, of the Strand), to whose inventions modern surgery is under considerable obligations, has remarked that steel seemed to be much improved when it had become rusty in the earth, and provided the rust was not factitiously produced by the application of acids. He accordingly buried some razor blades for nearly three years, and the result fully corresponded to his expectation. The blades were coated with rust, which had the appearance of having exuded from within, but were not eroded, and the quality of the steel was decidedly improved. Analogy led to the conclusion that the same might hold good with respect to iron, under similar circumstances; so, with perfect confidence in the justness of his views, he purchased, as soon as an opportunity offered, all the iron, amounting to fifteen tons, with which the piles of London-bridge had been shod. Each shoe consisted of a small inverted pyramid, with four straps rising from the four sides of its base, which embraced and were nailed to the pile; the total length, from the point, which entered the ground, to the end of the strap, being about sixteen inches, and the weight about eight pounds.

"The pyramidal extremities of the shoes were found to be not much corroded, nor indeed were the straps, but the latter had become extremely and beautifully sonorous, closely resembling in tone the [illegible] unding pieces of an oriental instrument, which was exhibit[illegible] the Burmese state carriage. When manufactured, th[illegible] convertible only into very

The manufactures of Spain fell with the Roman power, and were almost annihilated while under the dominion of the Goths; but they were again revived by the genius and in dustry of the Moors, who formed several independent kingdoms in the centre of the country. The Spaniards, driven to the mountains, and having acquired a spirit of energy which they had not for a long time experienced, had the wisdom to profit by the example of the Moors. Possessing the mines of Biscay, and the flocks of Leon, they retained the fabrication of woollen cloths and of arms, and allowed the manufacture of leather, linen, silk, &c., to remain almost entirely in the hands of the Moors.

After the death of Philip the Second the manufactures experienced an almost instantaneous decline, which nearly amounted to an absolute annihilation of trade. This was produced by the combination of various causes—the expulsion of the Moors in 1614—a general taste for foreign stuffs, in preference to those fabricated in the country—and the impolicy of the government in not only permitting the importation of foreign manufactures, but in laying a stamp duty, called *bolla*, upon articles manufactured in Catalonia, and a heavy tax upon silks. The effect of these measures was such, that the national manufactures were generally neglected, and in a short time almost entirely abandoned. The manufactures of cotton, linen, gloves, and swords entirely vanished; and, by the close of the seventeenth century, scarcely a vestige of the

inferior steel; the same held good with respect to such bolts and other parts of the iron work as were subjected to the experiment, except the straps: these, which, in addition to their sonorousness, possessed a degree of toughness quite unapproached by common iron, and which were, in fact, imperfect carburets, produced steel of a quality infinitely superior to any, which in the course of his business Mr. Weiss had ever before met with; insomuch, that while it was in general request among the workmen for tools, they demanded higher wages for working it. These straps, weighing altogether about eight tons, were, consequently, separated from the solid points, and these last sold as old iron. The exterior difference between the parts of the same shoe, led, at first, to the supposition that they were composed of two sorts of iron; but, besides the utter improbability of this, the contrary was proved by an examination, which led to the inference that the extremities of the piles having been charred, the straps of iron closely wedged between them and the stratum in which they were imbedded, must have been subjected to a galvanic action, which, in the course of some six or seven hundred years gradually produced the effects recorded."

former prosperity remained. Such was the state of destitution in which Philip the Fifth found the trade of Spain when he ascended the throne in 1700. The intestine wars which accompany a disputed succession, and the low state of the national finances, prevented for a time any attention being paid to the subject of manufactures; but Philip having restored tranquillity to his dominions, and established the public revenue, induced his subjects to wear the national fabrics, and thus laid a foundation for the revival of trade, which was ably and cordially supported by his successor, Ferdinand the Sixth. This prince not only encouraged the formation of manufactories, by peculiar privileges and pecuniary assistance, but also established several at his own expense, and by giving employment to foreign artizans, induced many of them to settle in the kingdom.

By the following returns it appears that a few years after Philip the Fifth came to the throne, the manufacture of iron was considerable, at least it may be considered so, for that period. The quantity of iron exported to Great Britain was, from the year 1711 to 1718, inclusive—

1711	1340	tons.
1712	1184	,,
1713	1261	,,
1714	721	,,
1715	1309	,,
1716	1750	,,
1717	2744	,,
1718	2192	,,
Total	12,501	,,

being an average on the 8 years, of about 1560 tons per ann.

From the year 1729 to 1735 inclusive, it was as follows:—

1729	1726	tons.
1730	1438	,,
1731	1551	,,
1732	1795	,,
1733	1860	,,
1734	1967	,,
1735	2072	,,
Total	12,409	,,

being an average on the 7 years, of about 1770 tons per ann.

From the year 1750 to 1755 inclusive :—

1750	1156	tons.
1751	1017	„
1752	1293	„
1753	348	„
1754	1035	„
1755	969	„
Total	5818	„

being, upon the average of the six years, about 970 tons per annum.

From which period the trade in iron with Great Britain continued to decline in quantity, and in

1786	only	50	tons were exported.
1787	„	146	„
1788	„	244	„
1789	„	69	„
1790	„	104	„
1791	„	76	„
1792	„	273	„
1793	„	45	„
1794	„	64	„

when the exportation ceased entirely.

Laborde, in his view of Spain, in the early part of the present century, informs us that the principal iron factories and forges of Spain are in Catalonia, Aragon, the three provinces of Biscay, and in the Asturias. Eleven are enumerated in the Asturias; fifteen in Guipuscoa; sixteen in Biscay Proper, which manufacture annually about 100,000 quintals; * twenty-five in the district of St. Andero alone, which annually produce 24,000 quintals. The principal forges of Aragon are those of St. Pedro, in the territory of Albarrazin, Origuela, Xea, Torres, and Tormon. There are manufactured in each district, on an annual average, about 2500 quintals.

* Every province has its own particular weights, but in the kingdom of Castile the pound generally consists of sixteen ounces, and of twelve in the kingdom of Aragon.

		lbs.	oz.
The quintal of	Castile is	100	0
„	Galicia	125	0
„	Biscay	154	13
„	Guipuscoa	105	$15\frac{7}{8}$
„	Aragon	111	$1\frac{2}{3}$
„	Valencia	126	0
„	Catalonia	91	0

Iron abounds in most provinces of Spain, and Biscay might have a far greater number of forges, or, at least, it might greatly improve those which it possesses. This province contains numerous iron mines, that of Samosostro, more especially, is very prolific, furnishing an abundance of ore, and of an excellent quality—but it is common property. Every person may dig there—take whatever quantity he chooses—sell it agreeably to his wishes, or send it where he pleases. The greatest portion of the ore from this mine is sent into the adjoining provinces. It forms an irregular bed, between three and ten feet thick. The metal is soft, ductile, and perhaps the most malleable of any in Europe. Toledo and Barcelona were celebrated for the superior quality of the arms and swords manufactured there. The largest forge in Guipuscoa is that of Aspeitoa: this country, at a former period, has been so filled with forges, that the forests which once covered it are nearly destroyed. Not any of the best conducted forges of Biscay, Alava, and Guipuscoa yield the proprietors above from 300 ducats (34*l.* 7*s.* 6*d.*) to 500 ducats (57*l.* 5*s.* 10*d.*) annual profits; while the profits of those in Aragon are nearly double; the first, on an average, do not produce a thousand quintals of iron each, while the last fabricate 2500 quintals.

Spain has also numerous iron mills; there are many near Tolosa, twelve in Biscay, forty-eight in the Asturias, and one in New Castile. These equally manufacture iron and copper; those in the Asturias are thus appropriated—two for copper, nine for bar-iron, and thirty-seven for the nail trade.

Iron foundries are established at Equi, in Navarre; Renteria, in Guipuscoa; and in the vicinity of Oviedo and St. Jago de Sargadelos, in the Asturias.

Iron ordnance is cast at Lierganez and Cavada.

Steel is manufactured at Utrillos, in Aragon, but in no very considerable quantity.

Locks, and various iron utensils, are made in divers places. Locksmiths are numerous at Vega de Ribadeo, in Galicia; at Helgoivar, in Biscay; at Vergera, Solsona, and Cardona, in Catalonia.

Different kinds of cutlery and other iron wares are also manufactured at these towns, particularly at Solsona, which are held in high estimation, although they will not bear competition with similar articles introduced from other countries. Shears, for the use of the clothing trade, are particularly manufactured at Monistrol, and Aulot, in Catalonia.

It would appear, from a report made to the deputation, or junta, of the province of Biscay, in 1827, on the state of the iron manufactures, that they were then very much depressed —hardly, in any instance, paying the expenses. This report was, however, made in the view of inducing government to prohibit the introduction of any iron, except that of Biscay, into the other provinces, and it may, therefore, be fairly presumed that it is a good deal exaggerated. In 1828 the iron manufactories were in considerable activity. They are very numerous, but none of them are on an extensive scale, generally employing only four or five workmen. There is only one smelting manufactory at Bilbao, and both funds and workmen seem to be wanting to conduct this operation on any considerable scale.

The importation of cast-iron utensils is prohibited, which affords a fine field, had the Spaniards talent and industry to take advantage of it. With the exception of the Biscay provinces, iron has not been wrought to any extent in Spain. The works commenced at Pederosa, in Andalusia, by a company in Seville, have not hitherto been attended with success, in consequence, it is said, of mismanagement.

On the opposite side of Andalusia, at Martulla, another company has recently been established, which brought machinery from Germany and England, and is expected to conduct its operations upon a scale not previously attempted in Spain.

In almost every village in the three Biscay provinces there are manufactories of some kind of iron ware; horse-shoes, coarse locks, fusils, and bedsteads, are the leading articles with which they supply the interior. A number of mules pass daily through Vittoria for the interior, carrying each about 200 lbs. weight of horse shoes. Government has an

establishment in Valencia for the manufacture of muskets, pistols, and sabres. There is another at Durango, carried on by private individuals.

There is a general complaint of the increasing scarcity of wood for fuel, and of its consequent advance in price. The coal mines nearest to Biscay are in Asturias, at Aviles and Gijou, but coal is hardly used in the manufacture of iron. It appears, from a report made by the Intendant of Asturias, in January, 1828, relative to a request made by a company established for the navigation of the Tagus, for permission to import foreign coal for the use of the steam-vessels they propose employing, that these mines are of great extent and very rich.

The lowest price at which coal can be put on board at Gijou and Aviles, varies, according to this report, from 13*s.* 6*d.* to 15*s.* 6*d.* per ton of 20 cwt.

The inquiries made by a committee of the junta of Biscay, in 1827, show an extraordinary variety in the cost of extracting the ore, as well as in the proportions in which ore, labour, fuel, &c., enter into the cost of iron.

	Per cent.
For every 100 lbs. of iron, the ore is valued differently, at from	$14\frac{3}{7}$ to $27\frac{1}{5}$
Fuel	$52\frac{1}{6}$ to $68\frac{10}{11}$
Workmen and labour	$1\frac{2}{3}$ to $10\frac{2}{3}$
Rent of buildings	$6\frac{1}{4}$ to $10\frac{3}{8}$

The exportation of iron ore is prohibited, but considerable quantities are, notwithstanding, sent to France. It does not appear that any of the manufactured articles are exported. A small quantity of iron in bars is exported to Bayonne and Bordeaux.

The average make of iron may be considered about 175,000 quintals, or nearly 8000 tons a-year.

Although the quantity of iron made in Spain is so trifling as to be totally inadequate to supply the consumption, yet the importation of foreign iron is nearly interdicted by the present narrow policy of the Government, which it is evident must prove very injurious. The following circular speaks strongly upon the subject:—

"The general deputation of the lordship of Biscay (Senorio de Viscaya), wishing to prevent the pernicious abuse that

may be committed by the introduction of foreign iron, which has already commenced in great quantities, the said general deputation, applying to this patriotic and important object the faculty confirmed to Biscay, by the order published by the Royal Council on the 29th of January, 1836, to levy additional duties upon articles of consumption when the ordinary duties were insufficient, has adopted the following measures:—

"Art. 1. All foreign iron that may be introduced into Biscay will, immediately on its being landed, be taken direct to the bonded warehouse of the deputation.

"Art. 2. After having been duly deposited in the bonded store, it will continue in the custody of the storekeeper.

"Art. 3. The bonded iron may be freely exported from Biscay, with a permit from the judge of contraband (Guia), on payment to the general deputation of eight maravedis per 100 lbs. for store room, should the time of its remaining in store not exceed one year; double that sum, should the time not exceed two years, and so on; and eight maravedis per 100 lbs. for weighing.

"Art. 4. The general deputation will adopt measures to prevent foreign iron from being smuggled into the country, on its way from the bonded stores to the line of the Ebro.

"Art. 5. Foreign iron imported for consumption in Biscay will pay to the general deputation, on being removed from the bonded warehouse, a duty in accordance with the following tariff:—

	Reals.
Forged iron in bars, bolts, &c., per Castilian quintal	70
Sheet iron, per ditto	30
Hoops for casks (not exceeding one line in thickness), ditto	3
Worked in locks or padlocks, per lb.	7
Files, chisels, hatchets, hammers, pincers, spades, tridents, &c., for each dozen pieces	8
Smoothing irons, per lb.	5
Steel in bars or wrought, per lb.	1
Steel in thin bars, for watchmakers' use, per lb.	3

(Signed) Fredrico Victoria de Lecea.
Manuel Maria de Musga.
Manuel de Barandica, Sec. *ad int.*

Bilbao, April 16, 1840.

CHAPTER VIII.

SWEDEN AND NORWAY.

SWEDEN has been long celebrated for its mines and mineral productions, particularly iron, which still forms one of the principal exports, although it has much decreased of late years. By an account taken by the government in the year 1748, we find that, at that time, there were 496 foundries, with 539 large hammers, and 971 small ones, for making bar and other manufactures of iron, which produced 304,415 ship-pounds,* or nearly 40,600 tons.

The government established an office in 1740 to promote the production of iron, by lending money on the ore, even at so low a rate as 4 per cent.; a correct register was then made of the mines, which is still continued. Each forge has its particular mark stamped on the bars of iron it produces, which is correctly copied into the manuscript, with the name of the place where the establishment is situated—the names of the proprietors of the work—the commissioner or agent for the sale of the iron—the assortment each makes, and to what country it is generally shipped—the quantity annually made by each work—the quantity which each work delivers to the government (which is about 1 per cent. on the quantity of the iron produced)—the estimation of the quality of the iron of each work, which is variable—the place and province in which the works are situated—the place from whence the iron is generally shipped—and how many hammers each work has—all which particulars are regularly and alphabetically described and arranged.

As the working of the mines is attended with considerable

* 7½ to a ton.

expense, and the sale of the iron uncertain, the Bank of Stockholm receives that metal as a proper security for a loan. The iron being duly appraised, and lodged in the public warehouse, the proprietor receives three-fourths of its value, at the interest of 3 per cent., and when he can find an opportunity to dispose of his iron, it is again delivered to him, on producing a certificate from the bank, that the loan upon it is duly discharged.

The following account of the state of the forges, producing 1500 ship-pounds of iron and upwards, is taken from the "Voyage de deux Français, dans le Nord de l'Europe; 1790-92." It is to be observed that they only speak of those forges of which the produce is taken to Stockholm:—

Name.	Province.	Shipp'ds.	Quality.	No.
Axmar	Gestricia	1500	*g*	2
Malingsbo	Dalecarlia	1500	*g*	2
Bakkammar	Westmania	1750	*g* & *m*	2
Boggo	Ditto	2127	*m*	3
Forsbacka	Gestricia	1600	*m*	2
Willingsberg	Nericia	1800	*g*	2
Watolma	Upland	2000	*g*	3
Bjorkborn and Bæufors	Wermeland	2070	*m* & *r s*	3
Lasona	Nericia	1748	*g*	2
Gammelbo	Westmania	2875	*m*	4
Wirsbo	Ditto	1725	*g*	2
Larsbo	Dalecarlia	2200	*m*	4
Engelsberg	Westmania	1539	*g*	3
Forsmark	Upland	2875	*g*	4
Maroker	Helsingia	2450	*r s*	3
Graninge	Angermannia	2000	*r s* & *m*	3
Gimo, Romæus, and Robersfors	Upland	2875	*g* & *b*	7
Finoker	Westmania	1943	*g*	3
Kihlafors	Helsingia	2000	*m*	3
Gravendahl	Dalecarlia	2450	*m*	4
Læfta	Upland .... 9 to	10000	*g*	6
Hasslefors	Nericia	1725	*g* & *b*	2
Austerby	Upland .... 5 to	6000	*m*	4
Lægdæu and Logfors	Medelpadia	1525	*m*	2
Olorsfors	Angermannia	2000	*m*	3
Koscis	Finland	1500	*g*	2
Kerby	Upland	2000	*m*	3
Paulistræum	Smoland	2400	*g*	4
Romnæs	Westmania	2025	*r s*	3
Bernshammer	Ditto	1950	*m*	2
Longwind	Helsingia	1600	*g*	2

Name.	Province.	Shipp'ds.	Quality.	No.
Schebo	Upland	2275	*m*	3
Niksiæu	Gestricia	1600	*g*	2
Stromberg and Ulfors	Upland	3100	*g*	4
Haugbo	Gestricia	1625	*m*	2
Woxna	Helsingia	1900	*g*	3
Krakfors	Nericia	1500	*g*	2
Suderfors	Upland	1840	*b*	5
Gysinge	Gestricia	1800	*g*	2
Ferna	Westmania	2400	*m*	4
Tolfors	Gestricia	1800	*g*	2
Finspong	Ostrogothia	1810	*m*	4
Lædvicka	Dalecarlia	2400	*m*	3
Hargs	Upland	3400	*g*	5

m, middling; *g*, good; *r s*, red-short; *b*, best.

There are in all 299 large forges, which furnish 227,507 ship-pounds, besides 92 small ones belonging to a company of peasants, furnishing 18,236 ship-pounds.—Total, 245,743 ship-pounds. These forges employ 373 hammers; there are besides, twelve inconsiderable forges, of which neither the hammers nor the products are stated.

The iron mine of Dannemora, the most celebrated in Sweden, is situated in the province of Upland, about one English mile from Osterby, and thirty English miles north of Upsala. This mine was discovered in the year 1448, and though it has now been wrought for nearly four centuries, it still yields abundance of the best iron in Europe.

The iron mine is on a hill so little elevated above the surface of the neighbouring country as easily to escape observation. It is about two English miles long, and nearly half a mile broad; it is almost surrounded by lakes, those of Dannemora, Films, and Grufve, lying quite contiguous to it. On the side where there are no lakes there is a turf moss. The ore forms a large vein in this hill, which stretches in a north-west and south-east direction. The mine was some years ago inundated by the water from the adjacent lakes; a strong wall, however, has been built to keep off the water. It is drained by two steam-engines, kept at work by means of wood for fuel.

It was first wrought as a silver mine, the silver being ex-

tracted from galena. This source of emolument soon failing, or becoming unproductive, the iron ore began to be extracted and smelted, and the excellent quality of the iron gradually drew to it the attention of the public. At first it belonged to the King of Sweden, but that monarch consigned it over to the Archbishop of Upsala as a part of his revenues; at present it belongs to a number of private individuals, who work it separately, each on his own account.

At the side of the mine is a large opening, about fifty fathoms deep and fifty wide, and at the lower part of this is the entrance to the mine, which is wrought about thirty fathoms deeper than this opening. The mines are thus described in "Coxe's Travels," who visited them in the year 1790:—"The pits are deep excavations, like gravel pits, and form so many abysses or gulfs. The descent is not, therefore, as is usual in mines, down a narrow subterraneous shaft. At the side of the mine I stepped into a bucket, and, being suspended in the open air, in the same manner as if a person was placed in a bucket at the top of Salisbury spire, was gradually let down to the ground by a rope and pulley. The inspector accompanied me to the bottom, and while I was placed at my ease in the inside upon a chair, he seated himself on the rim of the bucket, with his legs extended to maintain the equilibrium. He had in his hand a stick, with which he gently touched the sides of the rock, and the rope of the ascending bucket, in order to prevent our bucket from swerving against them, which must have infallibly overset us.

"While hung suspended in mid-air, and so giddy that I could not venture to look down, I observed three girls standing on the edge of the ascending bucket knitting, with as much unconcern as if they had been on *terra firma;* such is the effect of custom. We were about five minutes in descending, and the depth which we reached before I stepped out of my aërial seat was 500 feet. Not being a mineralogist, my curiosity was soon satisfied; I again got into the bucket, and was drawn up in the same manner.

"The inspector informed me, that the richest ore yields 70 per cent. of iron, the poorest 30—that, upon an average, the

collective mass gives one-third of pure mineral—that about 12,000 tons are annually drawn from the mines, which yield about 4000 tons of bar-iron.

"The mass of ore occupies a small compass. The length of the pits, considered as one, is 760 feet, and the breadth from three to twelve. The ore runs from east to west. The richest ore is near 500 feet in depth, and the Storoe Grube is not yet fathomed.

"The matrix of the ore being a calcareous earth, consequently contains but little sulphur, which is, perhaps, the reason of its superior quality."

The ore is blasted with gunpowder. The part of the vein which lies under the great opening, which forms the mouth of the mine, is called *stor rymning;* it constitutes by far the greatest portion of the mine. The next portion is called *jord grufva* (earth mine), and it yields the ore of the very best quality. The portion farthest south is called *sodra grufva,* or southern mine; it yields the worst kind of ore of all the three, probably from being mixed with galena and blende. The rock through which the vein runs is said to be quartz. The substance immediately contiguous to the vein appeared to Dr. Thomson to be hornstone, and to contain hornblende. The ore itself contains limestone, quartz, and actinolite, and affords from 25 to 75 per cent. of cast-iron. In the worst kind of ore Dr. Thomson also perceived blende, fluor-spar, galena, and amethyst, but in small quantities. Carbonate of lime, crystallised in dodecahedrons, also occurs in this vein; and likewise sulphate of barytes, mountain cork, and the aplome of Haüy.

The ore is broken into small pieces, and roasted; it is then put into conical-shaped furnaces, constructed of the slag from cast-iron. In these furnaces it is mixed with the proper quantity of charcoal, and then melted and separated from the slag. The cast-iron obtained in this manner is as white as silver, completely crystallised, and very brittle. The cast-iron is reduced to malleable iron by heating it in a bed of charcoal, and hammering it out into bars. In this state it is whiter than common iron, and is less liable to rust, is dis-

tinctly fibrous in its texture, and much stouter than any other iron.

The quantity of iron which this mine yields every year, amounts as before stated to about 4000 tons; the whole of it is sent to England, to the house of Messrs. Sykes, of Hull, where it is known by the name of Oregrund iron, taking its name from the port at which it is shipped.

The first, or best, marks are (L), which sells at 40*l.* per ton.

" " $\left.\begin{matrix} OO \\ C_L \end{matrix}\right\}$ " 39*l.* "

while the best Russian mark, the C.C.N.D., seldom fetches a higher price than 20*l.* per ton.

The cause of the superiority of the Dannemora iron has never been explained. Some chemists ascribe it to the presence of manganese. Berzelius attributed it to the presence of the metal of silica, while others suppose it to arise from the nature of the process employed. Dr. Thomson was assured by one gentleman, who had bestowed particular attention to the subject, that by following a similar process he has obtained as good iron from other Swedish ores. But that something is due to the ore itself is evident from the circumstance, that the quality of the iron, though the same process is followed, differs a good deal, according to the part of the vein from which the ore is taken.

In the neighbourhood of the mines are establishments for forging the iron, and for the accommodation of more than 300 workmen and their families. Each of the little villages has three or four regular streets, often planted with trees, a church, a school, and an hospital.

The whole make of iron in Sweden was, in the year 1803, 364,315 ship-pounds, or about 48,000 tons, taking 7½ ship-pounds as a ton English; in 1812 it had increased, as appears by the following table, to 431,137 ship-pounds, or about 60,000 tons.

Counties.	Iron Mines.	Produce of the ore in ship pounds.	Smelting furnaces.	Forges.	Privileged iron works to the 15th June, 1803. Iron bars in ship pounds.	Privileged iron works to the 15th June, 1803. Coarse iron utensils in ship pds.	Total produce in iron.
Vesterbotten and Norbotten ..	2	2,000	4	7	2,595	..	2,595
Wester Norrland..	..	..	5	15	9,539	1,469	11,008
Norrland	2	..	9	22	12,134	1,469	13,603
Stockholm	6	5,751	6	5	10,970	..	10,970
Upsala	19	72,940	13	9	24,646	1,585	26,231
Vesteros	17	100,516	31	49	42,339	1,077	43,416
Nyköping	12	81,482	8	22	12,854	1,946	14,800
Orebro...........	55	164,431	82	64	53,548	5,167	58,715
Carlstad	35	126,818	35	69	66,214	1,974	68,188
Stora Koppaberg..	20	146,000	72	56	32,712	4,932	37,644
Gefleborg........	6	21,168	30	47	43,365	905	44,270
Svealand	170	..	277	321	286,648	17,586	304,234
Linkoping	3	3,000	13	25	13,693	1,906	15,599
Kalmare	..	..	10	13	6,505	..	6,505
Iönköping	1	8,000	14	11	4,775	517	5,292
Kronaberg	..	..	13	10	3,366	323	3,689
Skoraborg	..	..	2	9	6,043	112	6,155
Elfsborg	..	..	..	10	5,289	3,949	9,238
Götaland....	4	..	52	78	39,671	6,807	46,478
Total ..	176	..	338	421	338,453	25,862	364,315
New works since 15th June, 1803	..	..	..	..	47,257	19,565	66,822
Total ..	..	..	..	..	385,710	45,427	431,137

In 1833 there were in the whole of Sweden from 330 to 340 smelting furnaces, producing 90,000 to 95,000 tons of pig-iron; in converting this into bar-iron, about 23 per cent. is allowed for waste, and as near as can be ascertained the annual manufacture of this latter is 63,000 to 65,000 tons. The number of iron works is about 420 to 430, having about 1100 forge hammers. The annual export of bar-iron, on an average of ten years, ending 1831, was 49,568 tons. The smelting furnaces and iron works are licensed for a particular quantity, some being as low as 50 tons, others as high as 400 to 500 tons per annum; some few bar-iron works draw licenses for 1000 tons each. The licenses are granted by the College of Mines,

which has a controul over all iron works and mining operations. The iron masters make annual returns of their manufacture, which must not exceed their privilege, on pain of the overplus being confiscated, and the college has subordinate courts, called courts of mines, in every district, with supervising officers of various ranks; and no iron can be sent to any port of shipment without being landed at the public weigh-house, the superintendent of which is also a delegate of the college, and his duty is to register all that arrives, and to send his report quarterly to the college. It is impossible for an iron master to send to market more than his license. Many, however, sell at the forges to inland consumers, returns of which are never made, and so far licenses are exceeded, but it is supposed this excess cannot be above 3000 tons.

There is no chance whatever of the manufacture of iron in Sweden becoming free—on the contrary, there is much greater probability of its decrease, as in those parts of the country where iron works are established there are already as many forges as the neighbouring forests can supply with charcoal. If there are proprietors of forests on which they can prove that iron works have not been privileged in former times, in that case the government cannot refuse to grant the right of erecting works in proportion thereto—but, except either very far north, or far in the interior, there do not exist such woods.

It does not always follow that the forests belong to the proprietors of the iron works, but they have, nevertheless, the right of purchasing all the charcoal sold from these woods. We may consider the case in this manner:—A person, a century back, who had 20,000 acres of forest, may have obtained the privilege of manufacturing 200 tons of iron annually; the estate in the lapse of time has become divided amongst a number of heirs, or has been sold in lots to different persons; but the proprietor of the iron works still retains the right to the charcoal of the whole, if any is made, for sale.

There is no department in Sweden conducted with more fairness than the College of Mines, which manages these matters.

IRON EXPORTED FROM SWEDEN FROM 1830 TO 1838.

DESCRIPTION.	1830.	1831.	1832.	1833.	1834.	1835.	1836.	1837.	1838.
Bar-iron*	366,617	427,995	401,376	423,400	400,175	493,601	470,627	336,883	543,329
Pig-iron	8,500	6,097	7,022	6,627	6,476	5,762	9,749	7,485	10,336
Iron not specified	9	1,949	739	838	658	778	24,381†	38,674	26,140
Round iron	1,363	1,333	1,546	1,750	1,409	2,286	2,234	2,182	2,664
Spike iron	3,209	5,349	8,789	2,961	2,250	3,985	3,744	1,488	4,054
Sheet iron	10,858	2,153	2,009	1,963	1,798	4,821	2,326	2,055	2,626
Nails		9,125	7,505	7,760	8,422	4,745	6,303	7,970	7,816
Nail rods	838	1,087	627	537	849	780	884	652	779
Hoop iron	2,245	2,309	2,454	2,273	1,783	2,945	2,037	2,791	1,944
Castings, cannon, balls, &c.	1,911	2,905	3,816	7,214	5,307	4,561	7,670	8,119	7,228
Saltpan plates	165	176	187	158	123	157	98	67	213
Anchors, anvils, &c.	68	79	213	175	249	70	65	96	98
Ploughshares	114	356	370	584	508	382	552	577	1,044
Hardware	1,069	1,063	83	215	10	16	35	103	105
Scrap iron	2,445	2,922	2,996	2,270	1,669	2,651	2,012	3,449	3,844
Manufactured iron	1,261	1,156	842	789	831	929	548	517	424
Old cannon	31	..	115	32	..	..	..	..	473
Retorts	144	..	..	..	..	..	..	..	..
Chain cables	..	..	..	..	..	..	..	25	7
Machinery	..	..	..	..	..	..	..	..	30
Total ship-pounds	400,847	466,054	440,689	459,546	432,517	528,469	533,265	413,133	613,154
" tons	53,446	62,141	58,759	61,273	57,669	70,463	71,102	55,084	81,754

* Ship-pounds, 7½ to a ton.—† In 1836 seventy tons of pig-iron were sent to England; with this exception, the whole of the pig-iron went to Finland. Iron not specified also goes to Finland, with a trifling exception.

COUNTRIES TO WHICH EXPORTED.	1830.		1831.		1832.		1833.		1834.		1835.		1836.		1837.		1838.	
	Bars. Tons.	Other iron.	Bars. Tons.	Other iron.	Bars. Tons.	Other iron.	Bars. Tons.	Other iron.	Bars. Tons.	Other iron.	Bars. Tons.	Other iron.	Bars. Tons.	Other iron.	Bars. Tons.	Other iron.	Bars. Tons.	Other iron.
Great Britain and Ireland	9,851..	5	11,907..	55	11,717..	62	13,021..	12	11,509..	49	13,050..	42	16,530..	137	11,932..	3	14,546..	10
United States of America	15,532..	422	23,133..	683	20,002..	1222	20,644..	343	19,618..	287	28,728..	476	27,342..	560	10,709..	151	25,669..	585
France	5,749..	14	3,810..	..	5,398..	36	5,820..	40	6,304..	11	5,732..	56	3,574..	2	4,812..	18	7,413..	47
Norway	210..	310	261..	320	329..	79	251..	304	144..	129	179..	152	161..	213	162..	335	34..	176
Finland	460..	1618	661..	1268	617..	1449	851..	1455	719..	1370	792..	1428	348..	4626	603..	6923	1,098..	4952
Russia	30..	6	..	..	..	..	1..	70	..	1	..	2	..	154	..	..	1..	..
Prussia	3,319..	598	4,051..	1010	2,944..	862	2,419..	722	2,740..	892	1,936..	849	1,805..	865	2,453..	939	2,672..	935
Denmark	2,481..	926	3,557..	930	3,926..	788	4,330..	960	3,442..	844	3,306..	617	2,979..	911	3,846..	742	4,495..	1144
German States	3,508..	463	4,383..	540	3,724..	546	4,707..	607	4,712..	421	4,980..	549	5,160..	569	4,640..	552	6,742..	795
Portugal	2,705..	97	2,052..	104	1,319..	68	1,098..	55	1,093..	53	3,953..	214	2,482..	143	1,744..	106	3,327..	125
Holland	3,302..	76	1,110..	113	1,658..	66	1,302..	107	1,215..	80	1,809..	167	1,503..	104	1,718..	323	3,091..	347
Belgium	..	..	..	..	..	..	..	..	337..	..	133..	..	93..	..	..	53	152..	16
Austria	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	22..	5
Italy	85..	..	204..	2	27..	2	175..	26	301..	36	34..	8	93..	54	213..	7	272..	20
Spain	..	..	..	..	4..	17	..	..	..	..	..	2	..	4	..	..	..	..
Gibraltar	179..	6	94..	6	25..	..	87..	2	395..	15	36..	..	..	..	204..	4	71	6
Greece	..	..	..	..	..	..	..	..	5..	73	..	..	..	..	..	..	22..	2
East Indies	689..	..	353..	5	321..	3	624..	28	67..	3	75..	..	..	..	677..	..	1,004..	..
Brazil	704..	23	1,490..	39	1,505..	11	853..	27	654..	3	860..	14	674	..	1,083..	4	1,231..	94
Other parts of S. America	78..	..	..	..	..	..	..	..	58..	45	9..	..	..	..	10..	2	29..	3
West India Islands	..	..	..	..	..	32	254..	6	..	..	10..	..	..	..	..	..	88..	2
Africa	..	..	..	..	..	..	16..	56	44	..	193..	72	6..	10	112..	4	465..	46
Total	48,882..	4564	57,066..	5075	53,516..	5243	56,453..	4820	53,357..	4312	65,815..	4648	62,750..	8352	44,918..	10,166	72,444..	9310

NORWAY.

Of the mines of Norway, those of iron are esteemed the most profitable. They are chiefly situated not far from Arindal, in the southern province of Christiansand; and near them, between Arindal and Konsberg (according to Busching, vol. i. page 341), ochre is found at Wardhus, in Finmark, of a beautiful skyblue, probably like that of Elba, and is the sign of a rich iron mine. The iron ore of Arindal is black mingled with quartz. At Bderum the Count Wedel von Jarlberg has iron mines and works, where are made grates, pots, and a variety of other articles.

Oddy, in his work on "European Commerce," observes, that iron makes no regular article of export from Norway; yet there does not appear any reason why they might not have cultivated this branch of manufacture as well as Sweden. Wood they have in sufficient abundance. There are several foundries in Norway, but they have not been worked with spirit, their produce is therefore but small. Since the year 1792, they have not much extended their works. Moss, a town of a thousand inhabitants, contains a principal iron work. Skaggerak is also in repute for its iron trade.

PRODUCE OF THE IRON WORKS IN THE YEARS 1791 and 1792.

	Unwrought Iron.	Bar Iron.	Cast Iron Wares.	Forged Iron.
	Ship-pds.	Ship-pds.	Ship-pds.	Ship-pds.
Bolvig	3192	2843	647	
Barum	3102	2464	1474	
Dikkemark	1379	872	215	
England	1218	922	2	
Eidifors	2340	1663	252	
Fossum	1469	1151	1152	59
Frocland	2302	1436	1046	4
Ulifoss	2990	2480	932	29
Hassel	1678	1209	601	
Lessoi	—	50		
Mass	2201	959	491	—
Mostmarken	1034	194	232	

	Unwrought Iron. Ship-pds.	Bar Iron. Ship-pds.	Cast Iron Wares. Ship-pds.	Forged Iron. Ship-pds.
Nass	3662	2394	616	
Qudal	2037	1954	426	22
Total in 1791	28604	20591	8086	114
1792	26502	20483	8586	1693

IRON EXPORTED FROM NORWAY,*

In the years	1829,	1830,	1831.
Tons	3164,	3000,	2516.

* Porter's Tables.

CHAPTER IX.

RUSSIA.

Of the vast tract of country now comprehended under the appellation of Russia, we glean from ancient authors little that tends to illustrate the early history of iron.

The Scythian nations, from their mixture of rude, pastoral, and warlike habits, cannot be expected to supply posterity with their own history; we, therefore, are indebted to other sources for such information. The Greek authors do not much enlighten us in our researches after the extent of knowledge which the Scythian nations had of the useful arts, nor as to the extent of advantages they derived at that remote period, from the riches of their inexhaustible mineral soil.

The literary records of China, may, when explored, open at some future day, many interesting facts in the history of the Scythians, Tartars, and Russians; their early trading, and extent of their knowledge. It is much to be lamented that so vast a field of antiquity as China, has not yet been fully explored and ably gleaned. In that isolated empire, the arts and sciences flourished for ages anterior to the era of our Lord. Sematsien, who wrote his valuable history of China, 97 B.C., dates his authentic chronology from 841, B.C. After about six centuries (in which war and anarchy held sway), we arrive at the bright period of *revival* of learning and improvement in letters, by the invention of paper and printing; about 206 B.C. We may also mention that about this time the great wall was built, mainly as a defence against the nations at war with China; the latter, by the adoption of the improved nature and quality of the arms of her opponents,

became victorious, the cuirass and lance being now of common use. This brief notice, we conceive, justifies our expectation that China possesses much which we think may enlighten the industrious enquirer. The immense value of iron as material for arms, was manifest wherever introduced, and its great superiority over other metals so employed, immediately commanded attention. Those nations who had previously been ignorant of its manufacture, seeing its utility, would at once become eager to obtain it and learn the method of procuring it from their own soil. Such reverence did the Scythians pay to a sword of iron, that they worshipped it as the shrine of Mars.—Herodotus, lib. iv. Again; we learn from the same source, that "the Massagetæ had all their arms, their spears, arrow-heads, battle-axes, helmets and breast-plates of *brass* decorated with gold; they use neither silver nor *iron*, which indeed their country does not produce." "The Scythians," he says, "possess neither silver nor brass." Lib. lxiv. 71.

The ancient writers knew little or nothing of the north parts of Scythia, or the hyperborean region of Siberia, in later times found to be immensely stored with valuable minerals, and surpassingly rich in ores of iron.

In Siberia, at a time reaching back beyond all history, mining was vigorously practised by a nation bearing the name of Tschudes, whom Georgi takes to be the ancient Mandshures: an interesting account of the mine works of this nation, may be read in Pallas' Travels, tom. iii. p. 608 to 610.

Thus, Russia, we see, was possessed of iron ores from time immemorial, but previous to the reign of Ivan Vassillievitch, history says nothing of any regular mining operations. This prince, in the year 1491, sent two Germans to the river Petschora, on mineral discoveries, who were so fortunate as to find silver and copper ore. During the reign of Ivan Vassillievitch the Second, the English, by a treaty concluded in the year 1569,* obtained the privilege of seeking

* The communication with Muscovy had been opened in Queen Mary's time, by the discovery of the passage to Archangel, but the commerce to that country did

for and smelting iron ore, on condition that they should teach the Russians the art of working this metal, and pay, on the exportation of every pound, one denga, or halfpenny.*

The first regular mine works, which may be properly so called, were established about ninety versts from Moscow, by two foreigners, who, in the reign of the Czar Alexy Michaelovitch, were at Moscow, on commercial affairs, and had found ore in that territory—they requested, and obtained permission to work it.

These works, the first and only ones in Russia, prior to Peter the Great, were visited by that monarch, who wrought in them himself before he set out, in 1698, on his first journey into foreign countries. Remaining some time in Saxony, he not only made himself acquainted with the arts of mining, but requested the King of Poland to give him some workmen; and, in the following year, twelve of them, with a master at their head, and the assayer, Bluher, went to Russia, where they found ore in the districts of Kazan and Kalula, and began to work. The emperor, however, finding that with these two establishments he should be in want of people, sent Bluher, in 1701, again to Saxony, who returned in the same year with several persons skilled in mining, and repaired immediately to Olonetz, where they opened a mine of copper ore. The subsequent journeys of Bluher, gave the first occasion to the discovery of the Siberian minerals, for in the

not begin to be carried on to a great extent till about the year 1569. The Queen (Elizabeth) obtained from the Czar (John Basilidus) an exclusive patent to the English for the whole trade of Muscovy. After the death of John Basilidus, his son Theodore revoked the patent, which the English enjoyed for a monopoly of the Russian trade; when the Queen remonstrated against this innovation, he told her Ministers that princes must carry an indifferent hand, as well between their subjects as between foreigners, and not convert trade, which, by the laws of nations, ought to be common to all, into a monopoly, for the private gain of a few. So much juster notions of commerce were entertained by this barbarian than appear in the conduct of the renowned Elizabeth! Theodore, however, continued some privileges to the English, on account of their being the discoverers of the communication between Europe and this country.—*Hume.*

* Of the first arrival of the English, and the origin of their commerce, there is an account in the "St. Petersburgh Journal," vol. ix. p. 149.

year 1703, he was dispatched to the Permian mountains, near Solikamsk, where he found an old mine; whence he proceeded further along the Kama, and soon after his return to Moscow, made a fresh journey in the districts of Azof, Astrachan, and pushed forward to Caucasus.

In the meantime the emperor had appointed Lieutenant-Colonel Henning to be director of the mines of Olonetz— a foreigner of great activity, who restored the old ruinous iron works, and put them in a condition to furnish the newly-created navy with large and small cannon, and other iron ammunition. In the year 1719, Henning travelled through several countries of Europe, for the purpose of collecting information concerning the state of the mines and foundries; and, on his return, got together by permission of the Kings of Poland and Prussia, a considerable number of master workmen, by whose assistance he set up several wire manufactories, forges for steel, hammers for tin plates, and making iron bars, steel furnaces, anchor smithies, and other engines, all worked by water.

As it appeared from the accounts delivered in, that ore was to be found in almost every part of the empire, Peter the Great, in the year 1719, constituted a peculiar mine college,* and shortly after sent Major-General Henning, whom he had promoted for his useful services, in quality of director, to Siberia, for the purpose of completing the works already begun there. Henning established a chief mine office at Ekateringburg, and a subordinate office in the territory of Perm; he also built several work-shops, furnaces, forges, foundries, and mills for flattening and slitting; and within the space of six years, had made such progress in all these works, that the various expences attending them were repaid, with interest, by the metals obtained. In the years 1726 and 1727, he sent annually 140,000 to 150,000 poods† of

* On the 1st of May, 1784, the mine college came to end, being dissolved by an ukase, bearing date January 27, 1783.

† Sixty-three poods to a ton, or 2268 lbs. English.

bar-iron, besides a great quantity of other kinds of wrought-iron, by means of the water communication from Siberia to Moscow. These services procured him the rank of lieutenant-general of the artillery, and the post of general director of all the copper and iron works in Siberia.—(*Schlœtzer, from Von Haven*, pp. 85-92.)

The art of mining, which, properly speaking, had taken its rise under Peter the Great, was thus, by the wise and unwearied exertions of that prince, encouraged and advanced in all imaginable ways. In the year 1716, the emperor, by a manifesto, had given his subjects the first encouragement in mining. In three years afterwards he instituted the college of mines, and, "as his empire was full of subterranean treasures, and these rich sources of subsistence were hitherto neglected, partly from ignorance, and partly from the insecurity of the possession," he found it necessary, with the view of encouraging the search after ores, and the working of mines, to establish several remarkable privileges. By an ukase of the year 1720, these privileges were extended to all foreigners, without distinction. Other ordinances, of similar purport, enjoined that persons who were searching for ores should have no impediments thrown in their way—that the woods about the works should be kept up—and that, for the protection of the mines, fortresses should be constructed on the frontiers.

Such was the state of the Russian mines when Peter the Great quitted the stage on which he had laboured so much, and with such great success.

Akinfy Demidof, a wealthy individual, and the father of the Uralian mine works, in 1725, received intelligence of the Tschoudian mines in the mountains of Kolyvan, and caused them to be visited by German miners, whom he had at former works. As here were found very rich veins of copper ore, he erected some works in the year 1727, adjoining to the Lake Kolyvan. The number of his labourers was soon increased by people who had run away from the estates to which they belonged, whom he, by a special privilege, might admit and

employ in his works; and a considerable number of crown boors were at the same time granted him.

In the reign of the Empress Anna, the iron mines began to be of such consequence, that, in order to gain the preference from the Swedish iron, the price of the Russian was fixed at 56 copecs* the pood.

The mine undertakings of private individuals met with every needful encouragement. Whoever discovered a mine, and was inclined to work it, was allowed to make the proper dispositions in erections, diggings, &c., for which he was granted ten years free; the adventurer was put in possession of the property of the ground as a freehold, provided it belonged to the crown,† with convenient places on the banks of streams and rivers for the works and necessary buildings, and a considerable extent of forest; and when he had no boors of his own that he could set to work, he received a certain number out of those raised for recruits, who were to remain, as well as their posterity, with the works. If these proved insufficient, other boors were given him to perform the occasional labours in lieu of their head money, which the owners of the works were obliged to pay in their stead. In all private undertakings of this sort, the crown retained certain *imperialia*.

1st. A yearly tax on every furnace—for the principal one in iron works 100 rubles.‡

2d. Of crude iron, one-tenth.

3d. All sorts of vessels for the artillery and the admiralty, for a stated price, settled in 1715 and 1728.§

* 100 copecs to a ruble.

† The crown has occasionally not merely granted one of its mine works, but has regularly sold it to a private individual. Thus, one of three iron works, and that a very productive one, was purchased, with all the people belonging to it, pits and erections, together with a considerable forest, for 200,000 rubles, as we are informed by Professor Pallas, who also mentions another in similar circumstances. The crown has also bought some of them back again.

‡ A ruble 4*s*.

§ The Empress Catherine the Second, by several edicts, relinquished the *imperialia*, and abolished the taxes. The delivery for the admiralty and artillery was given up in 1770, and, as an act of grace, on occasion of the peace of 1775, the

In regard to the workmen, it has just been observed, that, at first, it was the practice to assign a certain number of crown boors to private adventurers, many of whom, being of the class of merchants, had no vassals, and could not procure any voluntary workmen; those labourers were to work out their head-money in that capacity; but, from this method, oppression arose—the people were allowed no respite from labour, and hardly any recompense. During the reign of the Empress Elizabeth, these men, no longer able to bear the oppression under which they groaned, rose against their employers, and the government was obliged to send some regiments of soldiers to suppress the insurrection. Many most distressing scenes occurred in consequence, which were finally put a stop to by the Empress Catherine the Second, who, on ascending the throne, immediately adopted measures for checking the flagrant proceedings of the masters.

In the year 1766 she appointed a commission, composed of the chief officers of state, to examine into the matter, and to lay before her their proposals for an alteration; but as there was no hope of a termination to this weighty concern, it being delayed by every kind of difficulty that could be thrown in the way, the empress issued some special precepts from her own hand, whereby the grossest of the abuses were remedied for the present—till at last the laudable ordinance of the 23d May, 1779, appeared, by which the fate of the enrolled boors was fixed on a humane and equitable footing.

tenth of the capital of the minerals, as well as the tax on the furnaces, with the tenth of the raw iron, were remitted.

The tribute or taxes attached to private mines, altered by the ukase of the 28th June, 1780, are the following :—

1st. Instead of the tenths on each pood of raw iron, four copecs (100 copecs to a ruble) were paid. Since the 23d June, 1794, all iron works erected with the assistance of the crown pay an additional four copecs, and those without that assistance two copecs.

2d. For every forge the owner pays the crown 200 rubles yearly. Until the 23d June, 1794, only 100 rubles—at which time the tax was doubled.

3d. The duty on exportation on every *berkovetch* (ten poods) of bar-iron is thirty-seven copecs.—*Tooke*, 1799.

At the crown mines of Barnaul, besides their own people, they employ about 48,000 boors, who earn their head-money there—these people were always well treated.

The mines of Schlaugenberg, and in general the Barnaul, are in all respects of great consequence. They have iron-stone that yields 50 to 60 per cent. Herman speaks even of 70 per cent., but most commonly it is 25 per cent.

In the Uralian mountains, in the year 1779, there were generally at work 70 forges and 532 large hammers, besides two smelting-houses, in the Altaian and Sayansk mountains, and several in the governments of Olonetz, Vologda, Nisney-gorod, Kostroma, Kursk, Tula, Tambof, &c. In 1798 there were in the whole empire about 100 forges and 800 hammers; but, besides these large iron works, there are a great many smiths, who smelt the ore at home, and of the iron make various kinds of utensils. Such little smithies are principally in the governments of Olonetz and Archangel—in some regions of the Volga, and in Siberia, near Krasnoyarsk, Yenisiesk, &c.

The produce of the mines at the Uralian iron works of the governments of Perm, Ufa, and Winska, amounted, in the year 1782, to 3,940,400 poods of wrought iron; and, as we may allow for all the other Russian and Siberian governments at least a million of poods, the total quantity of iron manufactured will be about 5,000,000 poods,* independent of the various cast wares, which are not included. To obtain this quantity of wrought-iron, it requires from seven and a half to eight million poods of raw iron. The average produce of iron, from the year 1779 until 1793 or 1794, was about 80,000 tons annually, of which about one-half was exported, and to that end conveyed to St. Petersburgh, which, even from the Ural, notwithstanding the great distance, is done

* The largest iron works belong to the families of Demidof, Yakovlef, Stroganof, Tverdischef, Lazaref, Luginin, and Bateschef. The family Stroganof possesses, in the government of Perm alone, 540,000 square versts of land, and had on it, at the revision before the last, 83,453 vassals of the male sex. Of the private works and villages there are many which, in magnitude, in neatness of buildings, and in the number of their inhabitants, exceed most of the towns in this government.—*Tooke*, 1799.

almost throughout by water.* The expense of this transport, which is greatly favoured by the rivers and lakes of the Uralian territory, comes to, for the greatest part, from fifteen to twenty, for some above twenty, and for a small proportion about twenty-five copecs the pood. With the majority of the Uralian iron works the pood of iron delivered at St. Petersburgh did not cost more than fifty-five, or, at the most, sixty copecs the pood. The other half was used in the interior and at the various manufactories—the cast-iron is principally disposed of to the Asiatic nations.

The manufactures increased by the prohibitions that took place in 1794, when the importation of all hardware was prohibited (scythes excepted), which the Russians could not make in sufficient quantities. The following is a statement of the manufactures about the year 1798 :—

"*Iron Foundries.*—Almost at every iron mine, where there is a forge, cast-iron ware is prepared in clay and sand, various sorts of pans, pots, kettles, and other domestic utensils, as also such as are wanted at the mines and manufactories. At almost all the mines, particularly at those belonging to the crown in Siberia and at Olonetz, they cast cannon and other implements of artillery. At Petrozavodsk, in the government of Olonetz, is a grand cannon foundry, where iron cannons are cast, of excellent workmanship, by means of a cupola furnace. The principal castings hitherto produced by the Siberians are some masterly balustrades and railing, with a few statues, cast at the foundry of M. Demidof.†

* This navigation first commences on the borders of China, passing by the Selivga to the Baikal Lake, from thence, upon the Angara into the Yenesei; as far down as Yenesei, there the iron is unloaded and carried over a short tract of land, and embarked on the river Ket; from thence down that river into the Ob, from which, up the Irtish, the Tobol, and thence overland to the Tchussovaia; upon which river it is embarked again, and goes into the Kama, and the Kama into the great river Volga.—*Oddy.*

† The history of the origin and wealth of this most respectable family, and of their possession of such productive mines, is not destitute of interest, and I believe to be correctly, as follows :—" The Demidofs are descended of a very industrious working miner, who had a small iron mine on the confines of Siberia. This was the great-grandfather of the present generation. Peter the Great, on visiting the spot, upwards of a hundred years ago, was much pleased with the activity and reputation

"*Iron Works.*—Here are meant all manufactories where raw iron is wrought into malleable iron and various instruments and utensils. Of these are bar-hammers, that are connected with every forge. A great majority of the iron here consists in thick bars, whereby the works reap infinite advantage, as many of them can be made at less expense, trouble, arts, money, and people. Indeed, several sorted irons are made, but proportionably in small quantities, quadrangular bar-iron, and thin wheel-iron or strakes. There are also, though not many, rollers and shears for cutting nail-iron.*

"*Steel Hammers.*—Though there has been long in Russia, at several works, what is called "uklad," or raw steel, or even, perhaps, refined steel, for the use of their own shops, made merely of old iron, yet not made, as has sometimes been said, of half raw iron and half bar-iron.

"For obtaining true steel, it has been advanced that they forge together the bar-iron with an equal weight of raw iron, without cooling the raw iron or remelting it; bend it together, if it be straight, forge it again, and repeat this three or four times."

A company of Frenchmen, and others, attempted, some years ago, to make cemented steel of Siberian bar-iron. These works, however, came to nothing; but, seeing that every year great quantities of foreign steel were imported, a manufactory was established, in 1785, by sovereign authority, at

for honesty of Demidof, and being anxious to encourage the working of mines, and also to set an example of emulation for others, made him and his heirs, for ever, a present of an extensive district, immediately surrounding his small patrimonial mine, with full liberty to work it. The enormous extent of ground thus obtained, proved a source of inexhaustible wealth to the good miner, for it was found to cover some of the richest veins of iron, of the finest quality, in Russia. Its produce soon enriched the industrious proprietor, and his son, having continued to work the mine, and to explore more ground, was enabled to employ the enormous capital thus justly acquired in purchasing additional estates, and among others that of Nijnétahilski, in which a gold mine was discovered soon after, that has yielded, on an average, forty-nine poods yearly, or 100,679*l.* sterling in pure gold."—*Granville's Travels.*

* A very curious article, produced by the Russian workmen, are the little bullets, which are made in the village Pavlovsk, on the Volga. They are no bigger than a pea, and cost, in Shahlenborg's time, only half a ruble per dozen—at present one of them costs as much.—*Pallas.*

at Ekateringburg, on the model of that at Steyermark,where, from raw iron alone, a strong condensed steel, like that of Steyer, is prepared, and where since, as the works have been enlarged, as much steel can be made as is wanted for the empire, though the ores of those parts have by no means the quality necessary for that purpose.

Anchor Forges.—There are, at several of the mine works, very large anchors made, both for the use of the navy and for exportation.

Flatting Mills, at which tin plates are made for home consumption.

Nail Manufactories.—Most of the nails for the inland trade are made by the smiths in some districts of the Volga, for which they generally use the slit iron from Siberia. There is a manufactory of nails near Narva.

Wire Mills are not numerous, and do not make enough for home demand, therefore wire and wire work are imported.

Needle Manufactories.—There is a needle fabric in the Pranskoi circle, and a needle maker lives in Reval; nevertheless, several millions of needles are imported every year.

There is no manufactory for scythes in Russia. In three years were imported, at the ports of the Baltic alone, 2,118,033 scythes. If we add to this what come in through Poland and over the Euxine, the number will amount to greatly above a million per annum. In Moscowa scythes cost usually fifty to sixty copecs, but in Siberia they are not to be had for less than a ruble. At some of the mines attempts were made to make scythes and sickles; however, they turned out but badly, and, therefore, the business was dropped.

Manufactories of Fire Arms.—In the empire are four, all belonging to the crown. The oldest, and the greatest, is at Tula. It was put on its present establishment in 1717, and employs upwards of 4000 workmen. Besides muskets and side-arms, at Tula, are likewise made bits for horses, various kinds of locks, iron bedsteads, frames for sofas, taburets, chairs, and stools of iron, shears, files, chains, &c. So early as under Peter 20,000 muskets and 10,000 pairs of pistols were made every year at Tula; and at Petrozavodsk 12,000

muskets and 6000 pairs of pistols. In the ten years, from 1770 to 1780, at Tula, were made for the field regiments (those who never change their head quarters) 112,893 muskets for the infantry; 4584 for the yœger corps; 18,333 for the dragoons; 2347 musquetoons for the fleet; 42528 carbines, 324 blades, 63,073 pairs of pistols, 11,170 large scymitars, 51,639 sabres, 933 hangers, and 95,590 side-arms for the infantry.

The price of a musket for the infantry is four rubles, for the yœgers five rubles, for the dragoons 397 to 409 copecs; a carbine 331 to 389¼ copecs; a pair of pistols 369 to 384½ copecs; a dragoon sabre 243¼ copecs; a hussar sabre 266 to 300 copecs; an infantry side-arms one ruble, a large scymitar 269 copecs.

The second is Sestrabek, forty versts from Petersburgh; the third is at Petrozavodsk, in the government of Olonetz; and the fourth in Orel. That at Sestrabek has upwards of 400 master workmen.

The works at Tula were, by supreme command, newly built in 1782, for which 388,000 rubles were allotted: it delivers every year arms for 15,000 men. Its yearly expenditure amounts to about 100,000 rubles, for which, besides the above, a considerable quantity of arms are made.* The

* The Emperor of Russia has just set out to inspect the southern provinces of his vast empire. It is confidently asserted that the object of his journey is to examine, himself, the terrible disaster caused by the burning of the manufactory of arms at Tula. Whoever feels the importance of such an event in Russia, will not be astonished at the promptness with which the emperor proceeds to this place. In the town of Tula were the only manufactories of fire-arms and swords in the Russian empire. It contains also three cannon foundries and 600 forges, which supplied cutlery and hardware to all parts of Russia. The arms which were made in that town vied in appearance with the best of those of England or France, but were not equal in solidity. The environs of the town consist of villages belonging to the crown, and whose inhabitants are entirely exempt from taxes or military service; although living in a fertile plain, slightly undulated and covered with immense fields of wheat, these poor slaves, excited by despair, and unable to procure sufficient subsistence for their families or themselves, set fire to the manufactories—which act has become their utter ruin.

For ages past, these skilful, but wretched, workmen had laboured from father to son for miserable wages, which were hardly sufficient to support them. The mode of working adopted in this manufactory never allowed the men to complete an entire

manufacturers receive for their own work 25,000 poods of crown iron. In 1797 the following tariff was published at St. Petersburgh :—

DUTIES UPON EXPORTATION.

		R.*	C.
Iron, old and broken	per berkovetch †	1	0
,, in bars of all sorts	,,	0	40
,, in lumps, not wrought........	,,	0	80

DUTIES UPON IMPORTATION.

Steel, per cask of three poods	1	30
Needles, per 1000	0	30
Wire for needles, per pood	0	12

Goods imported at St. Petersburgh in 1797, with their amount in rubles :—

Needles, 58,000,000	56,410 rubles.
Steel, 1220 poods.........................	10,143 ,,

Exports from all ports of the Russian empire, except those of the Caspian, in the year 1793 :—

	Poods.	Value in Rubles.
Bar-iron	2,503,757	4,258,228
Sorted	491,575	901,464
Plate iron, kettles, and other cast-iron wares..........	37,917	44,433

weapon. One village was obliged to furnish so many thousand barrels—another so many blades—and another so many screws, and so on. These were afterwards deposited in the warehouses of Tula. As there was in Russia no other manufactory, and as the continual wars of Russia required enormous supplies, each new campaign of the autocrat became a source of additional misery to the workmen. It may be easily conceived that, under such circumstances, they would seek to put an end to their insupportable condition. They imagined that if the manufactories ceased to exist, the emperor would establish others at St. Petersburgh, and even were he to take only a part of the workmen to the capital, their condition could not but improve. But they were mistaken in their hopes. The emperor is accompanied by architects, charged to rebuild the manufactory, and he goes himself to choose a more suitable plan, and to hasten the conclusion of the works. The embarrassment of the government can scarcely be described. Fortunately, however, for them, the arsenal of St. Petersburgh was sufficiently provided with arms of every description.—*Times Paper, Oct.* 15, 1834.

* The ruble may be estimated at 4s., during the greater part of the reign of the late empress.—*Tooke.* The present value is about 3s. 1d. A ruble is divided into 100 copecs.

† A berkovetch contains ten poods.

Comparison of the amount of the exportation in 1768 with that of 1793, in rubles :—

	1768.		1793.		Increase of 1793.
Iron..........	1,443,000	....	5,159,000	......	3,716,000
Small iron ware	20,000	....	44,000	......	24,000

And in 1798 there was exported in British ships from St. Petersburgh :—

Iron	2,352,217 poods.
Old iron	24,860 ,,
Hoop iron	2,120 ,,

To such an extent had the trade in iron with Great Britain increased, that the government of Russia imagined that we could not carry on our manufactures without their assistance. They raised the price, by degrees, from 70 to 80 copecs per pood, which it was in 1770, up to 200 to 220 copecs for new sable, and 250 copecs for the best old sable. And, in 1794, the government established a loan bank, to accommodate the Russian iron masters, by advancing them money on the security of their iron, to compel the English to give them such prices as they demanded.

In 1798 the proprietors of the iron mines succeeded in procuring a prohibition to the exportation of timber altogether, which they afterwards modified, with a view of benefiting themselves.* This measure was the means of raising the price of iron, in consequence of the additional freights the English were obliged to pay, because they could not get deals sufficient with which to load their ships. In 1790, in consequence of a fall in the price of wood, a new regulation was made, partly through the influence of the iron proprietors, who maintained, that if the English must have deals, they ought to be proportioned to the quantity of iron they took, which was, therefore, regulated at 284 standard dozen of white wood deals, for every 100 tons of iron.

By an ukase, in the spring of 1804, half that quantity of wood was allowed, in addition to the white wood deals, for the same quantity of iron. To these ill-advised measures may be added

* In the government of Perme alone it is supposed that betwixt three and four hundred thousand tons of charcoal are consumed to smelt and work iron and copper.

the following arbitrary conduct on the part of the Emperor Paul, who had in various instances displayed the capriciousness and irrationality of his character. He indulged a resentment against England on several accounts, of which the principal was the disappointment of his expectations of obtaining possession of Malta, which he fancied due to him as the grand master of the order. Particular attention had also been paid to him by the French Government, and he had become an avowed admirer of the character of the first consul. As he was very open in his declarations, he had caused to be inserted in the *Petersburgh Gazette*, of Sept. 10, 1800, as the motive for posting large bodies of troops on the coasts of the Baltic, that several political reasons induced the emperor to think that a rupture of the friendship between Russia and England might ensue; and he published in the same paper, in the end of October, a declaration of his determination to revive the armed neutrality. Shortly after, he took the decisive step of laying an embargo on all the British ships in his ports, amounting to near 300, accompanied with the measure of taking out their masters and crews, and sending them into confinement in remote places of the interior. He also sequestered all British property on shore, and put seals on all warehouses containing English goods. He announced that the embargo would not be taken off till Malta should be given up to Russia, conformably, as he said, to the convention of December, 1798.

The emperor's actions had long denoted insanity, and having become intolerable to his subjects, and dangerous to those about him, he was removed from his throne by the only mode practicable under a despotic monarchy; and, on the 22d March, 1801, it was announced that he was found dead in his bed. His son and successor, Alexander, immediately declared for the laws and political system of his august grandmother, Catherine the Second; and one of his first acts was to liberate and bring back from their places of confinement all the British mariners belonging to the sequestrated ships.

England, by these acts, was thrown on her own resources, and with the aid of improved machinery, and the great alter-

ations which had taken place in the process of manufacture, was soon able to do altogether without the assistance of Russia, if we except the C.C.N.D. old sable iron, which is extensively used in the manufacture of steel.

We learn from Mr. Granville that, in 1828, there were throughout the whole extent of Russia, as well as in the Ural chain, nineteen foundries, forges, and mines belonging to the crown, yielding annually 1,301,000 poods of mineral, which, independently of a vast number of pieces of artillery manufactured out of it, produced 500,000 poods of pure iron, 12,000 poods in anchors, 9000 poods in steel, and crucibles for smelting silver ore, and 32,000 small arms.

The establishments belonging to private families were 148 in number, yielding annually from 7,453,999 to 8,622,396 poods of mineral, out of which were made from 5,142,921 to 6,120,997 poods of iron, 23,379 to 70,244 poods of steel, and 234,873 scythes.

The duty which the crown received from this produce amounted to from 802,220 rubles 96½ copecs to 1,268,365 rubles 95¼ copecs on the mineral.

According to "Porter's Tables" there were the following number of manufactories of steel, iron, and needles, in Russia:—

Years.	Number.
1812	33
1816	75
1820	88
1824	170

EXPORTS OF IRON.

Total quantity of iron exported from Archangel in the following years—about sixty-three poods to a ton:—

Years.	Poods.	Years.	Poods.
1795	106,885	1800	75,581
1796	152,553	1801	85,868
1797	175,542	1802	153,781
1798	157,127	1803	74,951
1799	68,463	1804	4,016

Iron exported from Archangel to Great Britain and Ireland, in the following years:

Years.	Poods.	Years.	Poods.
1795	64,422	1800	57,565
1796	104,349	1801	70,188
1797	125,386	1802	116,623
1798	97,026	1803	58,723
1799	37,791	1804	——

Iron exported from St. Petersburgh, in the following years:—

Years.	Poods.	Years.	Poods.
1787	1,699,478	1795	——
1788	2,479,982	1796	2,329,766
1789	2,072,596	1797	1,857,710
1790	1,998,556	1798	2,689,842
1791	2,646,132	1799	2,019,379
1792	2,234,780	1801	1,495,799
1793	2,630,239	1802	2,055,018
1794	2,173,006	1803	2,205,707

Iron in bars exported from St. Petersburgh to Great Britain in the years 1753 to 1804:—

Years.	Poods.	Years.	Poods.
1753	441,440	1779	1,337,299
1754	498,956	1780	1,770,411
1755	733,196	1781	3,203,487
1756	458,716	1782	1,255,269
1757	338,736	1783	1,615,760
1758	514,228	1784	2,644,162
1759	863,579	1785	1,938,944
1760	630,894	1786	1,792,986
1761	1,014,967	1787	1,565,131
1762	754,415	1788	2,206,242
1763	740,990	1789	1,831,181
1764	1,091,488	1790	1,706,106
1765	1,532,086	1791	2,347,145
1766	756,767	1792	1,869,842
1767	1,152,018	1793	2,325,254
1768	1,550,352	1794	1,732,698
1769	2,141,673	1795	2,023,241
1770	2,157,192	1796	1,837,593
1771	2,172,201	1797	1,579,658
1772	1,581,827	1798	2,345,287
1773	2,124,467	1799	1,584,920
1774	1,877,878	1800	908,805
1775	1,531,458	1801	1,058,281
1776	1,958,992	1802	1,421,264
1777	2,268,719	1803	1,665,496
1778	1,139,703	1804	868,420

Iron in bars exported from St. Petersburgh to France in the following years:—

Years.	Poods.	Years.	Poods.
1772	102,330	1788	96,383
1773	121,865	1789	86,959
1782	137,496	1790	92,946
1783	17,515	1791	99,070
1784	75,591	1792	43,758
1785	48,950	1793*	——
1786	59,485	1803	9,700
1787	11,571	1804	32,837

Iron exported from St. Petersburgh to America, from the period of its independence to 1805:—

Years.	Bars. Poods.	Nail Rod-iron. Poods.	Hoop-iron. Poods.
1783	6,615	..	..
1784	6,612	..	..
1785	38,618	..	15
1786	31,858	2322	..
1787	10,833	1260	61
1788	17,054	846	378
1789	24,981	1259	411
1790	78,160	2526	..
1791	48,136	2621	757
1792	132,380	1132	1830
1793	177,826	1071	3576
1794	256,635	694	1959
1795	206,089	504	1284
1796	296,691	6405	2019
1797	112,260	560	1002
1798	142,654	1259	631
1799	239,885	126	503
1800	112,568	314	1260
1801	269,709	426	427
1802	309,425	21	..
1803	413,822	..	253
1804	278,264	..	..

Iron exported from St. Petersburgh in the year 1804 to the following countries:

Prussia	2,050	poods.
Lubeck	1,470	„
Denmark	16,254	„

* By an ukase of March 1793, all intercourse with France was prohibited.

Amsterdam	8,388	poods.
Spain	16,396	„
Portugal	6,940	„
Italy	18,803	„

The exportation of iron from Russia has been upon the decline since the year 1784, when the whole export from Archangel and the Baltic was about 50,000 tons, of which Great Britain took above 40,000 tons; and in the year 1781 she took from St. Petersburgh alone 3,203,487 poods, which is about 50,000 tons. In the year 1804 Great Britain imported 868,420 poods, nearly 14,000 tons; and in 1805 only 5848 tons.

Bar-iron exported from Archangel and St. Petersburgh from the year 1824:—

ARCHANGEL.		ST. PETERSBURGH.	
Years.	Poods.	Years.	Poods.
1824	20,790	1824	700,734
1825	63,000	1825	988,347
1826	35,910	1826	594,808
1827	64,575	1827	871,648
1828	65,016	1828	689,628
1829	118,440	1829	1,096,480
1830	117,180	1830	602,520
1831	86,688	1831	930,429
1832	..	1832	1,189,649
1833	..	1833	828,935
1834	..	1834	546,008
1835	..	1835	731,514
1836	..	1836	998,748
1837	81,854	1837	660,424
1838	22,064	1838	648,650

Of which quantity the principal part is exported to the United States.

	1832.	1833.		1834.	
	Bars. Poods.	Bar. Poods.	Sheet. Poods.	Bar. Poods.	Sheet. Poods.
Great Britain	350,689	299,441	..	130,108	..
United States	803,508	504,750	64,234	345,080	13,186
Continent	17,098	24,744	..	70,820	801
France	18,399		..	..	..
	1,189,694	828,935	64,234	546,008	13,987

In 1831 the exports to the United States were 537,000 poods.

Exports from Russian ports in the Caspian sea :—

ASTRACHAN AND BAKU.

IRON.

Years.	Value.	Years.	Value.
1824	£17,449	1828	£23,967
1825	15,978	1829	38,162
1826	7,107	1830	40,251
1827	10,555	1831	15,253*

	Cwts.	Value.
1830	88,830	£40,251
1831	44,869	15,253*

1830—Hardware, value, £7063 — 1831, £5266.

By caravans between Russia and Independent Tartary :—

IRON.

	Cwts.	Value.
1830	9226	£4211
1831	7204	3163

1830—Hardware, value, £12,469 — 1831, £9608.

	1837. Bar. Poods.	1837. Sheet. Poods.	1838. Bar. Poods.	1838. Sheet. Poods.
Great Britain	351,000	..	353,000	126
United States	262,000	40,000	270,000	36,593
Other parts	48,000	..	47,000	..
	661,000	40,000	670,000†	36,719

Leaving a supply to meet the next year's demand of 1,030,000 poods.

* From "Porter's Tables."

† Including the shipments from Archangel.

CHAPTER X.

FRANCE.

ANCIENT Gaul, comprehended between the Alps, the Rhine, the Pyrenees, and the ocean, contained within itself sufficient riches for the attraction of the industrious Phenicians, whose trading occupations rendered them at a very early period acquainted with the inhabitants of Gaul and Spain, to whom it is more than probable they communicated their methods of working mines and metals with a view to their own advantage, in the same manner as they instructed the early Britons afterwards. The warlike nations of Gaul appear to have been well armed, and their prodigious armies were well disciplined. Their early practice of mining had rendered the uses of metals familiar, and the army which had nearly sacked Rome under Brennus, about 370 B.C., and the host led by another Brennus into Greece, 278 B.C. to plunder the Temple of Apollo at Delphos, both mark advanced skill and organisation. Cicero mentions his opinion, that the Gauls were the most obstinate and formidable enemies of the Romans, and were so powerful, that had they been able to find sustenance they might have destroyed Rome, prior to their subjection by Julius Cæsar. We have just traced this outline in order to confirm the fact of the progress of the early Gauls in the art of war, the sinews of which are metals, and especially iron, which abounds so largely, and the manufacture of which was well known amongst them. We find that the most ancient inhabitants of this country occupied themselves in the manufacture of this metal as a matter of the first necessity; this fact is attested by Rutilius, Strabo, and particularly by Julius Cæsar, in

speaking of the vigorous resistance which the Berruyers made while he was engaged in the siege of Bourges. He says—"They took down our embankment by mines, the more scientifically, because they have great iron works, and every kind of mines known and in use."*

Thus, then, long before the conquest of Gaul, the Berruyers worked their iron mines; and proof of the immense extent of their works is found in the enormous heaps of cinders which are to be seen in various parts of the forests and open lands of the department.

These works were carried on with portable furnaces and forges, which were worked by manual labour or beasts of burden—which cannot reasonably be doubted, because, where these cinders are found, there are no streams of water, nor are there to be found any traces of water having ever flowed there.†

Such was the state of this branch of industry when the Romans, after having made the conquest of Gaul, applied their knowledge in mechanics to the construction of furnaces and forges worked by streams of water.

Abundance of iron ore is found in France, particularly in the north-eastern departments. The ore is not unfrequently found in large lumps on the surface, and the strata are most commonly but a few feet below it. The Pyrenees abound in large banks containing iron ore. There is an iron mine of considerable repute at Vicdessos, situated very high in these mountains, about fifteen miles to the south-west of Tarascon, and not far from the frontier of Spain. The "chantiers," or places where the ore is dug, are some hundred fathoms deep, and the passage to them, in many parts, very narrow and steep. Up these passages the ore is brought, with amazing toil, on the backs of the miners. Some carry 100 lbs., some 120 lbs., and some even more, according to their strength.

* Lib. vii. c. 21.

† That method was adopted in the department of the Cher, but not exclusively so, since there were also at the commencement of the last century portable forges in the canton of Henrichemont, and it is not many years since the bellows of the works of La Guerche were worked by oxen or horses, when the waters were too low for the purpose.—*M. de Barral.*

The mine is the property of government. There are generally 400 persons at work in it, under inspectors, but paying themselves by the sale of the ore to the forge-masters. It is miserably wrought—without a single improvement, Mr. Birkbeck supposes, since the days of Julius Cæsar. The ore is rich, and containing calcareous spar, is reduced without the addition of any other substance. It lies very irregularly, under lime of a schistose appearance. The mass of ore is in some parts upwards of sixty feet of thickness. The miners are mostly proprietors of land. The whole surface of the mountain is divided into patches of different dimensions—all cultivated and watered with the utmost assiduity, and clothed with luxuriant vegetation. There are also abundant mines of iron in Upper Languedoc, in the mountains of the Rouergue, which bound the western part of the province; and in the county of Foix, which joins Languedoc to the south, there is a mine of iron, so extensive, that it has supplied forty foundries for upwards of two centuries. In these parts the furnaces to the iron foundries, instead of being blown with bellows, are supplied with a current of air, by means of water precipitated through a vertical tube, to which is given the name of a *trombe** —the same word which is used in France for a water-spout. This practice is of very ancient standing. There are also iron mines in Franche Compté, Lorraine, Champagne, and Berri, near the departments of Cher and Indre. The department of Cher being peculiarly adapted to the growth of wood, of good quality, and presenting in several parts a great extent of land rich in iron ore, of the best quality.

Towards the end of the last century the French Government took active measures to become acquainted with the state of the mines, and also to introduce any improvements which would facilitate the working of them. Scientific men were sent to the most celebrated mines of Europe, and a Royal College of Miners was established, where distinguished *savans* taught gratuitously all the sciences connected with the sinking of mines. The young men admitted to the lectures had before them a collection of minerals, comprising the mineralogical

* See page 81.

history of the kingdom; and, to join practical to theoretical knowledge, indispensable to the miner, the pupils in the summer season devoted their time to the most important workings —pursuing their labours under able instructors.

In furtherance of their object to obtain a knowledge of the mines which furnish the first materials, and also of the forests, the wood of which is consumed in the manufacture, the government, in the year 1784, appointed the Baron de Dietrich to make a general survey, and report on the state of the mines and manufactures, and to estimate the extent of the forests relatively to the establishments which are consuming them, in order that government might check the increase of works in some places, or authorise the erection of new ones, as the state of the forests would allow, and the local interests might require.

The baron accordingly visited and reported on the whole extent of the Pyrenees, included in the districts of Pau and Auch, Alsace, and the duchies of Lorraine and Bar.

By his report it appears that, in the districts of Pau and Auch, they made, in thirty-eight forges, 75,800 quintals, of 100 lbs., of forged-iron. Alsace, 92,000 quintals of cast-iron, and 62,720 quintals of forged iron. Lorraine and Bar, 204,750 quintals of cast-iron, and 145,150 quintals of forged-iron. Also in Franche Comté 40,100 quintals of cast-iron.

The memoir does not show how much of this cast-iron was used in the forges, nor what was employed in making castings, but it states that a considerable quantity was consumed in castings, and also that a portion of the metal was sent to the Duchy of Luxembourg.

At this time, encouragement was given by the government to the establishment of works for the use of coal instead of wood, which subject occupied considerable attention. The memoir of the Baron de Dietrich states, that the queen, in order to encourage those of her subjects who wished to form establishments for lessening the consumption of wood, gave them her patronage, and wished that a considerable capital should be advanced to the forges and royal foundries of Indre—and, to give confidence to the nation, that the king

had not agreed to the adoption of the new processes until he had been convinced of the immense advantages which might be derived from them, the queen interested herself directly in the prosecution of the new undertakings.

"Four furnaces, thirty-nine feet high, form at Mont Cenis the iron work with coal, free from sulphur; four reverberatory furnaces are erected there, capable of making 12,000 lbs. weight at a single cast, and in a state to be refined with coke—an important discovery of the English, which has cost them twenty-five years' labour, and from which we shall reap the advantage as soon as they will."

Five engines are actively employed at the foundry of Creusot; they serve, at the same time, to raise from the bosom of the earth the coals which are consumed—furnish blast to the furnaces—and, also, to work the immense forge hammers. The absence of a stream of water, so often an obstacle to the erection of works in the best situations, will present no difficulties to such works as have recourse to these processes.

Works constructed like those of Mont Cenis, upon the land which will supply them with coal, will answer the double object of saving the expense (often ruinous) of the carriage of coal, and checking the destruction of the forests.

The briskness of coke, increased by the impetuosity and the volume of air given out by the bellows from the blast engine,* will increase to so great an extent the produce of one work, that the four furnaces of Mont Cenis will produce easily 10,000,000 to 11,000,000 lbs. of cast-iron per annum—a quantity that ten of our largest furnaces would hardly yield in working the same mines.

The memoir then calls on the works of Alsace and Lorraine to adopt the same methods, and states that the Comptroller-General intends to publish the particulars of the mechanism of the engines, in order to bring them the sooner into general use.

The annual produce of the 108 departments of the Repub-

* The largest bellows of our forges give 500 cubic feet of air per minute; the eight bellows, required for four furnaces, will give 2000 cubic feet; the three belonging to the engines furnish 9000 cubic feet in the same time.—*Baron de Dietrich.*

lic had already reached, in 1801, to nearly 140,000 tons of cast-iron, resulting from the working of 550 blast furnaces (1,000 kilogrammes to the ton); of these, 140,000 tons, about 111,000 to 112,000 were the produce of 450 furnaces belonging to France, reduced to her present boundaries.

The produce of wrought-iron in the 108 departments of the Republic, at that time, was 94,000 tons, of which about 79,000 were furnished by the eighty-six departments now belonging to France.

One single blast furnace (that of Creusot) was worked with coke.

M. de Bonnard (an engineer of mines) published, in 1809, by order of council, a description of the English process of making iron; another engineer of mines (M. de Gallois), after having passed several months in England, in studying their methods in the most minute detail, established near St. Etienne (in the same department where, some years later, a member of the same body, M. Beaumier, constructed the first iron railway) the first blast furnace in France, wherein the minerals were treated in the same manner as the English, and the third in which coke was employed.* M. de Gallois, notwithstanding the extent of his knowledge, both theoretic and practical, could not overcome the difficulties to be encountered by those who wish to introduce new processes into districts where they have hitherto been unknown; the blast furnace, constructed under his direction, had not at first that success which he had expected, and his premature death is attributed to the grief and trouble which this enterprise occasioned him.

The manufacture of wrought-iron with pit-coal proceeded step by step with the making of cast-iron with coke. In 1820 Messrs. Boiguer and Dufand, at Fourchambault, and M. de Vendel, at Hayange, had built extensive works, which have served as models for all which have since been erected. These examples were not fruitless; an increase was soon

* The first blast furnace in France, worked with pit-coal, was that of Creusot; that of Etienne is the second—it was only established in 1818.

seen in the number of iron works wherein pit-coal was employed, either partially or in the whole of their operations.

In 1818, the total consumption of iron in France did not exceed 122,000 tons annually, of which 114,000 were produced by the blast furnaces—5000 were old castings from the magazines—and 3000 were imported.

In 1824, the production had increased to 164,000 tons—the importation to about 7000—the consumption may be taken at 175,000.

	1818.	1824.
Production	114,000 tons.	164,000 tons.
Importation	3,000 ,,	7,000 ,,
Consumption	122,000 ,,	175,000 ,,

Referring to the statement already made of the production of 1801 in the departments now actually French; statements extracted from one of the best statistical works of that period, it is evident that the annual production of cast-iron from 1801 to 1818 had not materially increased.

It appears, also, from some approximative data, that the quantity of cast-iron consumed in the foundries increased nearly in the same proportion with the total quantity of cast-iron consumed. It was in 1818 and 1824 nearly a sixth part of the total quantity. The proportion of castings made at the blast furnaces bore nearly the same ratio to their produce of iron, being almost constantly one-sixth.*

Total quantity of bar-iron used in the years—

	1818.	1824.
Consumption	86,000 tons.	118,000 tons.
Made in France †	76,000 ,,	112,000 ,,
Imported	10,000 ,,	6,000 ,,

Thus, the production of bar-iron in 1818 was nearly the same as in 1801, or rather it was a trifle less; within ten

* It is estimated that the quantities of iron made into castings, in 1818 and 1824, may be stated at 20,000 and 28,000 tons, and the proportion made at the blast furnaces into castings, either at the first or second fusions, may be taken at 17,000 and 22,000 tons.

† From 9000 to 10,000 tons of these quantities of bar-iron have been made in the southern departments, by immediate reduction from the iron ore—a process commonly called the Catalonian method.

years the consumption was nearly doubled, the production actually so, and the importation was reduced one-half.

The iron imported into France was principally from Sweden and Russia.

The importation in the years—

	1822.		1823.		1824.		1825.
Swedish iron in tons, about....	1900	..	2400	..	3900	..	5400
Russian iron in tons, about....	100	..	140	..	330	..	540

We have already observed, that the first forges on the English plan were established in 1820. In 1823 there were eleven in work, and four building. In 1826 there were only four blast furnaces using coke in full work, but there were thirty-one forges, or wrought-iron works.

In 1818 only a very small quantity of cast-iron was made with coke, and no wrought-iron was prepared with pit-coal. In 1824 the produce of cast-iron with coke was about 3000 tons, but of wrought-iron manufactured with pit-coal, 4400 tons were brought into the market.

In 1828 the production of cast-iron was more than 200,000 tons, the importation about 8000, and the consumption about 213,000.

Bar-iron..—Quantity made in France, 152,000 tons; imported 6000 tons; consumption, 158,000 tons.

Quantity of iron made into castings 37,000 tons, and the proportion made at the blast furnaces 32,000 tons.

In 1828 the number of blast furnaces had increased to fourteen, and that of forges on the English plan to forty; 17,000 tons of cast-iron were smelted with coke, and 48,000 tons of bars made with pit-coal. Thus, the manufacture of cast-iron with coke chiefly developed itself from 1824 to 1828, whilst that of wrought-iron with pit-coal had already considerably extended itself in 1824.

These 17,000 tons of cast-iron, made with coke do not amount to a tenth of the whole produce; and the 48,000 tons of bars made with pit-coal form nearly a third of the total manufacture of wrought-iron.

This disproportion between the respective quantities of cast

and wrought-iron, as compared with the total produce, arises from the number of situations where it is found advantageous to make the cast-iron with wood charcoal, and to refine it with pit-coal.

M. Auguste Perdonnet, in his report made to the society "Du Bulletin Universel des Sciences et de l'Industrie," read at the sitting of the society on the 24th April, 1831, as to "what improvement has the art of making iron received in France during late years."

"I will say but few words as to the improvement which the art of making iron has received. The attention of the French iron masters has of late years been principally directed to the perfect naturalization of the English methods in this country, and to the advantages which might arise from combining together, the process of fabrication with wood charcoal, and those with pit-coal. They have, above all, applied themselves to economise fuel, the cost of which forms a very great part of their expenses.

"It is not many years since the working of our charcoal blast furnaces, being altogether left to the routine management of workmen only, was in a very backward state. But competition has succeeded much better in leading our iron masters into the way of improvement than all the advice of ingenious persons; and it suffices to compare the number of charcoal blast-furnaces, and their total produce in 1801 and 1828, to be convinced of the progress that has been made in their manner of constructing and working them.

"In 1801 it required 450 charcoal blast-furnaces, of which 420 at least were in work, to produce 112,000 tons of cast-iron. In 1828 only 379 furnaces produced 184,000 tons; thus, in the time elapsed between 1801 and 1828, the mean produce of a charcoal blast furnace has nearly doubled. At the same time, we are obliged, with regret, to acknowledge that all our charcoal iron works have not followed the progress of improvement. We yet find at a great number of them water-wheels, wretchedly constructed, and blowing machines more miserable.

"The reason why blast furnaces with coke have been so diffi-

cult to forward in France is, that our materials not being the same as the English, we have been obliged to make a great number of very expensive experiments to learn even now how to use them. But these furnaces have at last begun to give satisfactory results, at least in a technical sense.

"We should, however, very far deceive ourselves, if we were to form an opinion of the prosperity of our manufactures by their increased production. If we penetrate into these establishments, and examine them closely, we soon are convinced that this immense development of the means of manufacturing has not always been a source of benefit to the iron masters. Many of their works are in a state of real distress—enormous capitals have been swallowed up—each one in his turn has attempted their management—they have had in succession at their head clever theorists, expert practicians, Frenchmen, Englishmen, and Germans—the custom-house duties have been increased for their protection, and still they are in general far from being in a state of prosperity.

"The causes are numerous—the too great distance of some of these works from the raw material—also the bad quality of the mineral—or the inability, perhaps, of some of the persons to whom the management has been intrusted—and, lastly, the blow given to commerce by late events; all these circumstances have, doubtless, contributed to arrest the progress of the iron manufacture in France. But part of these circumstances have, at the present time, ceased—the cost of labour has much decreased, and the experiments are finished. The want of means of transit and communication is more grievously felt by our iron manufacturers than by any others, for some of our iron works are threatened with ruin from this cause, if it be not speedily remedied.

"Thus, at Fourchambault, at St. Etienne, Hayange, and other iron works where the cast-iron is made with coke, the expense of carriage alone amounts to one-third, if it be not nearer one-half, of the total cost of manufacture, so that the ton of metal is charged with 60, 70, or 80 francs for the cost of transport only.*

* The cost of transport upon an ordinary road may be estimated, on the average,

"We have an inexhaustible supply of minerals, excellent in quality—most of them equally rich with the English. We have pit-coals in abundance, many kinds yielding coke, well suited for the blast furnaces, and costing us less at the mine than theirs, except at a very few places. Limestone and fire-clay are to be had at the quarry equally cheap, and labour costs less in France than in England. But no where, as I believe, are all these raw materials found together exactly at the same point, as is the case in Wales, where the same mine supplies coal, ironstone, fire-clay, and limestone—or, if in some localities, as at Allais and at Aubin, they are near to each other—there are no canals or railways, or even good roads, to take the produce away."

There are at this time in France twelve distinct localities or districts, in which the making of iron is prosecuted, which are distinguished in the official reports:—*

1. Group of the north-east.
2. " of the north-west.
3. " of the Vosges.
4. " of the Jura.
5. " of Champagne and Burgundy.
6. " of the Centre.
7. " of the Indre and La Vendée.
8. " of the coal-fields of the south.
9. " of Perigord.
10. " of the Alps.
11. " of the Landes.
12. " of the Pyrenees.

to be 1f. 50c. for 100 kilogrammes carried one league (about four kilometres). At Chatillon, where they refine with coals the metal made with charcoal, the coal of Rive de Gier, their best for the purpose, costs 56f. per ton, whilst it sells for only 20f. at the pit. At Hayange, the coal of Sarrebuck, sold for 5f. per ton, costs 30f. At Fourchambault the coal of St. Etienne, only 5f. at the mine, comes to 30f. at the iron works. At Audincourt they use the coal of Rouchamps, which, bad as it is in quality, costs 25f. per ton on the place, and 38f. 50c. at the furnace, but it is only used in the chaferies to reheat the blooms before drawing them into bars.

* "A Statistical View of the Recent Progress and Present Amount of Mining Industry in France," by G. R. Porter, Esq.

The actual and relative importance of these groups may be seen from the following particulars, having reference to the working of 1836:—

Group.	Number of Iron Works.	Number of Workmen.	Quantity of Fuel in tons and steres.				Quantity of Products.			Value of Products in English Money.
			Wood charcoal.	Coke.	Coal.	Wood.	Cast-iron.	Bar-iron.	Steel	
			Tons.	Tons.	Tons.	Steres.	Tons.	Tons.	Tons	£
1	94	2233	90,844	3,530	8,230	33,583	46,233	30,450	162	530,599
2	59	1771	54,051	....	2,964	..	23,755	11,182	..	210,238
3	7	388	....	7,315	24,830	..	2,226	9,189	..	147,500
4	148	2090	126,754	....	910	..	54,737	28,900	581	652,030
5	152	2807	139.602	....	40,947	..	81,499	42,309	..	691,528
6	124	2133	71.098	14,094	35,798	..	36,993	27,029	766	501,362
7	21	499	17,564	....	....	..	5,824	2,870	..	61,085
8	15	1243	....	87,444	115,038	..	28,440	27,276	..	377,158
9	115	1175	39.120	....	3,399	..	14,893	9,064	96	173,646
10	39	174	6.614	....	251	..	2,021	282	1120	6,916
11	21	410	17,466	....	32	478	7,118	3.674	..	62,535
12	99	815	30,742	....	....	..	....	9,466	..	171,140
	894	15,738	593,855	112,383	232,399	34,061	303,739	201,691	2725	3,585,737

The figures given in the foregoing table do not present in all their importance the extent of this branch of industry in France. The number of workmen employed for the production of pig-iron (*fonte*), malleable iron (*gros fer*), and steel, which alone are there included, does not much exceed one-third of the number engaged in all the various processes of the iron manufacture; and the total value of the material produced, instead of being, as in the above statement, 3,585,739*l.*, amounted in 1836, according to the returns of the inspectors, to 4,975,424*l.* The following abstract contains all that it appears desirable to offer on this occasion, and presents under five principal divisions the total number of workmen engaged in the manufacture, with the value created by them in each of those divisions:—

	No. of workmen.	Value created.
1. Extraction and preparation of the ore	17,557	500,632
2. Production of pig-iron (*fonte*)	6,776	1,969,132
3. Production of malleable iron (*gros fer*)	8,678	1,506,247
4. Founding, drawing, rolling, &c.	8,615	812,486
5. Converting, moulding, casting, &c., steel	2,149	186,927
Total....	43,776	4,975,424

Rather more than 40 per cent. of the value here stated is made up of the cost of the fuel used in the various processes, viz.:—

Wood charcoal	£1,643,826
Wood	13,040
Coke	96,972
Coal	285,235
Peat	694
	£2,039,767

This sum is divided among the different processes in the following proportions:—

	£	Dec. Propor.
1. Roasting the ore	1,782	0·087
2. Smelting	1,132,039	55·500
3. Refining, puddling furnaces, &c., &c.	737,888	36·175
4. Casting, drawing, rolling, &c.	121,556	5,959
5. Moulding, casting, &c., steel	46,502	2,279
Total	2,039,767	100·000

It will be seen that four-fifths in value of the fuel is composed of wood. Coke was not used in the iron works of France until 1821, and at the present time is employed almost exclusively for processes subsequent to smelting the ore. The proportionate value of different kinds of fuel consumed in the various processes in each year, from 1833 to 1836, has been—

	1833.	1834.	1835.	1836.
Wood charcoal	0·838	0·818	0·864	0·806
Coal	0·098	0·129	0·098	0·140
Coke	0·062	0·050	0·037	0·048
Wood	0·002	0·003	0·001	0·006
	1·000	1·000	1·000	1·000

The average prices of the different kinds of fuel in 1836, as stated in the report, were—

Wood charcoal	54*s*.	10*d*.	per ton.
Coal	18	5	,,
Coke	20	3	,,
Wood	2	10	per stere.

The increased proportion of wood, observable in the working of 1836, is caused by the substitution in part, in some

works, of wood dried by heat or partially carbonised. By the introduction of a proportion of dry wood in place of charcoal, a diminution in the cost of fuel has been attained; but against this advantage must be placed the smaller produce obtained from the furnace in a given time, as well as a diminution of metal from a given quantity of ore. Where wood charcoal alone is used for smelting, it requires eighteen metrical quintals for the production of thirteen metrical quintals of iron. Where coke and coal are used in the proportion of ten of the former to nine of the latter, it requires about three quintals of fuel to produce one quintal of iron. In some cases, coke is used with charcoal in the proportion of one quintal of coke to two quintals of charcoal, and the produce has been eight quintals of iron for ten quintals of fuel. In the first case (where wood charcoal is used), the cost of the fuel has been 9·92 francs per metrical quintal of iron, or 4*l.* 0*s.* 6*d.* per English ton. The cost, when coke and coal are used, is stated to be 4·45 francs per quintal, or 36*s.* 1½*d.* per ton; and in the third case, where coke and charcoal are mixed, the cost is said to be 7·60 francs per quintal, or 3*l.* 1*s.* 8*d.* per ton. The value assigned to the produce is—

	Francs.		Per ton.
In the first case....	20·99	per quintal, equal to	£8 10 4
In the second case...	11·13	,, ,,	4 10 4
In the third case ..	20·32	,, ,,	8 4 11

The mixture of coke and charcoal would, upon the whole, appear to be the most profitable in its result. Deducting from the value of the metal the sum expended for fuel, there would remain, when charcoal alone is used, 4*l.* 9*s.* 10*d.* per ton; when coal and coke are used, 2*l.* 14*s.* 2½*d.* per ton; and when coke and charcoal are used, 5*l.* 3*s.* 3*d.* per ton. These calculations are, of course, wholly inapplicable to the circumstances in which the manufacture is placed in this country, from the actual and relative cheapness of our mineral fuel. The use of the hot-blast has been adopted in several of the furnaces in France. At first it was found that the iron thus obtained was not so well adapted for making bar-iron as that for the smelting of which cold air had been used; but some

modifications, which are not particularised in the reports, have been introduced into the process, and this advantage, it is said, has been remedied. No account is given of the quantity of iron made in France earlier than 1824; but from that year the account is regularly stated in the reports from which the following abstract (in English tons) has been computed:—

Years.		Pig-iron.		Malleable iron.
1824	....	194,636	....	139,564
1825	....	195,588	....	141,396
1826	....	202,756	....	143,336
1827	....	213,175	....	146,621
1828	....	217,604	....	149,117
1829	....	213,868	....	151,319
1830	....	222,965	....	146,242
1831	....	221,423	....	138,942
1832	....	221,660	....	141,336
1833	....	232,559	....	149,982
1834	....	265,028	....	174,507
1835	....	290,378	....	206,396
1836	....	3[illegible]3,739	....	201,691

As in the case of coals, the importations of foreign iron into France have kept pace with the increase in the native production. The custom-house accounts of that country are detailed with great minuteness, but it is not necessary here to particularise the quantities of each description of foreign iron used in France. The value so consumed in each year since 1815, and the amount of duty collected on the same, were as follows:—

Years.		Value of foreign iron imported for use.		Amount of duty collected.
1815	....	£87,556	....	£29,840
1816	....	98,063	....	45,600
1817	....	202,205	....	122,024
1818	....	163,173	....	89,491
1819	....	164,238	....	94,180
1820	....	162,107	....	81,517
1821	....	226,571	....	126,945
1822	....	144,193	....	74,540
1823	....	141,501	....	86,258
1824	....	164,812	....	94,157
1825	....	150,690	....	86,894
1826	....	218,212	....	130,326
1827	....	186,846	....	98,960

Years.	Value of foreign iron imported for use.	Amount of duty collected.
1828	179,635	95,073
1829	160,625	84,396
1830	187,117	100,476
1831	123,185	63,644
1832	159,222	82,192
1833	174,601	91,569
1834	200,573	104,598
1835	231,208	121,346
1836	252,702	122,842

Having traced the manufacture of iron to the present time, we will now refer to the measures of the French government to protect this branch of their trade. During the war, and the interruption to foreign commerce which it occasioned, several branches of industry grew up in France, or were considerably extended, for the successful prosecution of which she is not, under ordinary circumstances, any wise fitted. Of these iron may be specified as one. The extraordinary demand for warlike instruments, occasioned by the war, gave a powerful stimulus to this trade; and when peace was restored, those engaged in it were necessarily involved in considerable difficulties. But these, howsoever severe they might be in the first instance, were not of a sort that could have continued for any considerable period. Had no adventitious principle been interposed, the manufacturers would gradually have changed their business, and instead of producing cannon and muskets, would have learned to produce those improved agricultural and manufacturing instruments, that were either unknown in France, or obtained only from the foreigner—but matters were not allowed thus to adjust themselves. The iron masters represented to government that they were in a state of extreme distress, and that this distress was occasioned by the importation of foreign iron, and not by the transition from war to peace. The government lent a favourable ear to these representations, and, in consequence, the duty on foreign iron, which had continued at 2f. 20c. the 100 kilogrammes,* from 1790, was raised, in 1814, to 15f., being an increase of nearly seven times its previous amount. This, however, was

* A kilogramme is equal to 2 lbs. 2 oz. avoirdupois.

not found sufficient to secure to the iron masters that monopoly which they were naturally anxious to obtain, and, in 1821, they again represented that this enormous increase of duty was insufficient for their protection, and, on the 3d of November, in the same year, an ordinance was published relative to the importation into France of foreign iron manufactured by rolling.

The preamble of the ordinance refers to the law which authorises the government to change the regulations of the tariff of the customs, and to present the alteration to the Chambers in the form of a law project. Then, after stating that it is necessary to protect the manufactured iron of France against the competition of foreign iron, manufactured by rolling (the price of which is greatly inferior to hammered iron), it is ordered that, from fifteen days after the publication of the ordinance, all such iron, when imported, shall be placed in *entrepôt*, and shall afterwards pay the duty which may be fixed by law when taken out of the warehouse for consumption.

In the course of the financial discussions, some members of the opposition endeavoured to recommend a liberal system of commercial policy, and to imitate, in this respect, the example which England was now setting to the world. But propositions of this kind met with no favour from any party, and with vehement condemnation from the ministers. "Let the system of prohibition," said M. de St. Cricq, Director-General of the Customs, "be for an instant abolished, then Odessa inundates us with her grain—England with her steel, with her hardware, her cottons, and with almost all the objects of daily use and convenience, in which she possesses the same superiority over us which we have over her in the productions of our soil and the objects of our industry."—"Let us suppose these relations established between other countries, and observe the change in your situation. There is not a person who, understanding the interests of our trade, would consent to enter on the career of freedom."

The ex-minister, M. Laine, quoted England as an authority for severe commercial restrictions, and maintained that

her late departures from that system were not examples to be imitated by other countries. "England," he said, "had first adopted the system of exclusion, and it was not, therefore, very remarkable, that, finding it enforced against her, she should be inclined to change her practice. She had derived from prohibition all the advantages that she could hope for—she had accumulated immense capitals—her industry had been so much developed, that she was obliged to seek for a large outlet, and, perhaps, on this account, she had come to the point of saying—'Now we will receive you, only receive us.'"

The duty was again raised from 15f. to 25f. the 100 kilogrammes.

The duty is of two kinds—that of 15f. per 100 kilogrammes, which was imposed in 1814, and which is levied on iron fabricated with charcoal and the hammer—that is to say, on the iron of the North, of Spain, and even of the Netherlands: that of 25f., imposed in 1822, and which is chargeable on the iron fabricated with coal and the rollers—in other words, almost exclusively on the English iron.

"The French iron was, in 1814, at 60f. the 100 kilogrammes, but, as the most accurate calculation had made it clear that the iron masters could not afford to sell the common iron below 50f. to get any reasonable profit, it was understood that, below that rate, foreign iron should not be admitted to compete with ours in our own markets. The northern irons, the only ones whose rivalry was at that time taken into consideration, were generally sold in our staples at the medium price of 36f.—a tax of 15f. and (with the tenth) of 16f. 50c. was added to it in order that they might not be offered to purchasers below 52f. or 53f. But a few years afterwards a rapid depreciation, not hitherto warranted by better conditions in the means of production, having taken place in the prices at home, signalized the *invasion* of the English irons, which, being fabricated with coal and the rollers, were sold in our maritime *entrepôts* at the moderate price of 21f.; and it was only in 1822, after two years of recrimination and complaints, that it was deemed necessary,

both to protect our own charcoal fabrication, and to encourage the incipient efforts of France to fabricate with coal, to apply to this particular species of fabrication a tax of 25f. and (with the tenth) of 27f. 50c., which, making the cost 48f. or 49f., a rate very near that which had been fixed for the iron of the North, was considered less as a real aggravation than a rational—and in some degree, a necessary application of the principle of the tariff of 1814." *

These exaggerated duties completely answered the purpose for which they were imposed. In 1817 the importation of bar-iron alone was 18,789,014 kilogrammes, and continued to be a prosperous trade to the importers, in spite of the duty of 15f., till 1822. In 1821 the importation was 13,843,724 kilogrammes. The increase of the duty on English iron was immediately succeeded by the following decrease of imports.

In 1822 the importation	was	only	5,069,171	kilogrammes.
1823	„	„	4,521,656	„
1828	„	„	5,794,942	„

In 1828, the government, urged on by the complaints of the public against these high duties, appointed a commission to inquire into the state of the iron trade, and M. de St. Cricq, whose opinion on free trade has already been given, was chairman of the commission.

It had been the intention of the French legislature to favour the iron masters, into whose hands the difference of price created by the tax was intended to fall. These expectations were, at first, fulfilled; the iron masters made large profits, and doubled their production in the first six or seven years after the peace. What was the consequence? Their success drew fresh capital into the trade. "Of the 93,850,000f. of capital sunk," says the *Enquête*, "about 47,000,000f. belong to the newly-erected establishments." The manufacture was pushed forward with accelerated speed. Certain materials are necessary in the manufacture—the most indispensable of which is fuel, which, in France, consists chiefly of wood, or rather charcoal. If the *prix de revient*, or cost-price of iron at the furnace be examined by the data furnished to the commission,

* Enquête sur les Fers, 1829.

it will be found that the ore, inclusive of the mining expenses, forms only 11 per cent., whilst the fuel, exclusive of the cutting and carriage, amounts to 39 per cent. The increased production of iron gives rise to a greater consumption of wood —and what follows? The price of iron rises, but the price of wood rises simultaneously, with this peculiar disadvantage, that being of slow growth,* the market cannot be supplied with an increasing quantity of wood, as with an ordinary commodity, so that a general rise in price continues of necessity for a long period. An iron master at Chatillon-sur-Seine, in the Côte d'Or, says, that in 1822, he bought the *banne* of charcoal (fifty cubic feet) at 16f., for which he now pays 23f. 50c. In the Meuse the *banne* cost 18f. 3c. in 1822—it now costs 37f. 50c. At Fourchambault, in the Nivernais, the iron master bought the *corde* of wood (sixty-four cubic feet), in 1821, at 3f. 50c., which now costs from 5f. to 6f. In the Meuse it was 3f. the *corde* of forty-nine cubic feet in 1820—now it is nine. In 1818 the produce of the year's fall of the government woods brought into the Treasury 20,181,000f.; in 1828 the same quantity produced 29,309,000f., being a difference of nearly 50 per cent. in the price.

The prodigious effect of the iron manufacture on the price of wood becomes more credible, when we read the following words of M. Le Baron Pasquier, the reporter of the commission:—"The total value of combustible wood used every year in the forges, may be reckoned at 30,000,000f. (1,200,000*l.*), which is about a fourth of the forest revenue."

In spite of the tariff of 1822, the trade was not so profitable as it was before that period. One of the witnesses, an

* The total extent of the forests of France is 6,521,470 hectares (nearly equal to two acres)—this total, after deducting one-fifteenth part, which consists of large timber, and one-fourth of wood consumed in public and private establishments, is reduced to 5,610,833 hectares of wood, susceptible of being cut in twenty years upon an average—which allows to be cut annually 280,541 hectares. According to the evidence of various statisticians, we may calculate the annual cutting of wood in France amounts to 9,804,928 cords, of eighty cubic feet, or two and three-quarters stivers.†—*M. Heron de Villefosse*, 1827.

† A measure of wood equal to a cubic metre, or a little better than a cubic yard.

extensive iron master of Champagne, says—"We made some profit when we sold at 450f. (the 1040 kilogrammes), and we are now losers in selling at 500f.; the cause of which is, that, in 1819, the *banne* of charcoal cost 18f. 3c., while it now costs 37f. 50c."

The proprietors of wood (the landowners) received the profits.

In 1818 the manufacture of bar-iron amounted to 800,000 quintals—that of cast-iron to 1,400,000 quintals—all smelted with charcoal. The increased price of wood having led to the use of cheaper fuel, a vast number of the forges established by the new comers were erected on the English plan. We find that of 1,521,881 quintals, forged in 1828, 476,116, or nearly one-third, were made with coal. The difference in the cost of production is surprising. One of the witnesses says—that to produce 1040 kilogrammes, of ordinary iron smelted with charcoal, he is obliged to use five *bannes* and a quarter of charcoal, which, at 41f. 50c. per *banne*, amounts to 207f. 50c., whilst, to produce 1000 kilogrammes with coke, he has only to employ 1700 kilogrammes of coal, at 49f. 50c. per 1000 kilogrammes, which amount only to 84f. 15c. The proportion of the cost of coal to charcoal is nearly as nine to twenty. The difference in the expense of labour and carriage is not less striking. M. Pasquier says that labour and carriage form at least, on the average, 43 per cent. of the *prix de revient* of the wood-made iron, whilst in that of the coke-made iron they do not reach higher than 29 per cent.

The reporter avers that —"the average price of iron smelted with charcoal is 49f. 12c., and the average price smelted with coal is 38f. 50c." The result of the *Enquête* was, that the commission proposed that the existing tariff on iron shall be maintained for five years longer, at the expiration of which period the present import duty on foreign iron shall be reduced by one-fifth.

The following is an abstract of the speech delivered by the French Minister of Commerce, in the Chamber of Deputies,

on the 21st May, 1829, on the proposed alterations in the French tariff:*

"The king, gentlemen, has commanded us to lay before you a law project, containing certain modifications in the tariff of our custom duties, the principal provisions of which are the fruit of the researches and deliberation of a commission appointed to that effect. In recommending the appointment of this commission, gentlemen, I did not abandon my personal conviction. My opinion, which has been frequently expressed to you, remains unchanged, namely, that it was not expedient that every thing should be prohibited, nor every thing permitted. Unrestricted freedom for trade at home, and all the freedom compatible with manifest necessities for foreign trade, are the conditions of our industry of every kind. If a protecting system were to yield abruptly to a system of unrestricted freedom in transactions between all nations, foreign labour would come into the French markets, and usurp the place of national labour. A prudently-devised protecting system is the necessary and permanent regulator of the divers conditions under which nations exercise their industry. Almost every branch of French industry would be in peril the moment it had to stand in competition in the market of France, without protection, against foreign produce and manufactures. Even if, as some persons argue, the branches of industry destroyed could be replaced by other branches more profitable, this would occasion a social perturbation—the consequences of which could not be anticipated without alarm. It is not that France would cease to produce corn—to cultivate the olive-tree, flax and hemp, and to breed cattle, horses, and sheep, if the corn of the Crimea and Poland, the hemp of the north, the flax of Belgium, the oil of the Levant and Italy, the oxen of Germany and the Netherlands, the wool of Spain and Moravia, and the horses of Friesland and Mecklenburgh, were admitted duty free; but the price of all these

* Duchatet's (Secretary of State for the Department of Commerce) report to the king—1834. (J. Bourwingis' Reply, p. 22.) "Cast-iron could not formerly be imported in pigs under 400 kilogrammes. This *minimum* is reduced to 25 kilogrammes."—8th July, 1834.

objects would become discouraging, and, perhaps, insupportable, to the French grower and breeder. Still less would the iron works, the cotton, the linen, and woollen cloth, and the hardware manufactories of France, be able to stand against the unchecked invasion of English cotton goods, Flemish linen and woollen drapery, the iron and hardware of Sweden, England, and Germany. Even the flourishing manufactories of Lyons would receive a shock by the free importation of India silks, which, in 1820, at the outcry of the manufacturers of Lyons, were prohibited—instead of paying a duty of 20 per cent. By what other branches of trade, gentlemen, could those which I have enumerated be replaced? I admit that we should supply a greater quantity of wine to other nations; but I know no other article in which we have an advantage in point of price. Assuredly, our wine-growers would not purchase their prosperity by the ruin of so many other interests? and, besides, is it certain that this ruin would not reduce the consumption of wine at home in a proportion equal to or greater than we might obtain abroad? An advantage might at first accrue to wine growers by a greater sale abroad; but they would soon feel the painful effects of an inevitable re-action. Let them look at wealthy England, of whose market they are so envious; in that country the consumption of wine is scarcely 30,000 pipes, whilst a moderate tax on beer yields 200,000,000f. to the revenue. In countries where the vine is indigenous, a few of the best growths of France find a market; but in countries to which nature has refused the vine, other beverage is made use of, and little room is left for a consumption which the wealthy alone can obtain. The inference to be drawn from hence is, not that our present tariff is the best that can be, and that no figure can be altered; but that our productions and manufactures cannot dispense with a tariff. The question is, what extent of protection shall be given to each of the branches of our industry? Here is the controversy, and the field is sufficiently ample. The controversy arising between interests ever distinct and often opposed — the necessities of different branches of industry being variable in their nature, and a

need existing of protecting the interest of the consumer—attentive inquiries and prudent revisions became necessary from time to time. Objections have been started against the appointment of a commission, but when was it ever known that an examination of complaints was injurious to the interests of the complainants? Vehement complaints have been made upon the duty of foreign iron, and upon the utility and possibility of maintaining the actual colonial regime. The government could not suppose that there were no points connected with these subjects of which it might not be ignorant, and hence these questions were submitted to the commission. The general opinion of the commission, in which every doctrine had organs, and every interest defenders, is, that the commercial system is an obliged consequence of the political separation of nations; that in this system, prudently applied, is the guarantee of public and private property; that all unnecessary prohibitions are an evil, but that certain prohibitions may be indispensable; that the protection resulting from duties is, therefore, habitually preferable to that resulting from formal prohibitions; that there exist rights wherever interests have been created under the protection of the laws; and that in France a reasonable system of protection should be adhered to. This opinion of the commission coincides with my own, and if it adds nothing to my conviction, it inspires me with confidence in supporting it. You now know, gentlemen, upon what principles, and under the influence of what idea, the commission proceeded to the solution of the two weighty questions to which I have already referred. The problem that remained to be solved was, what degree of protection should be granted? It relates to iron and sugar—two articles of immense consumption in France. The commission began with the question on iron, and then proceeded to that on sugar. In 1814, at which period France knew no competition in iron, except that of the north, a uniform duty existed of 15f. per 100 kilogrammes. In 1822 the duty was augmented to 25f. Nothing but wood being at that period employed in working iron, the effect of the augmentation of the duty was to increase the price of iron and that of wood.

Coal, however, soon began to be made use of instead of wood, and the law of 1822 was justified in the protection of the capital of the new system of working with coal. The consumption of iron, however, became much greater than before, and hence the price of both iron and wood rose, because coal was as yet employed but in few iron works. The duty upon iron had been fixed at a time when the price of that article in England was only 7*l.* 10*s.* or 8*l.* per ton; but the price suddenly rose to 15*l.* and 16*l.* If it had kept at the former price, English iron would have come to the relief of the consumer, and supplied the demand, to which the quantity produced in France was not equal, in consequence of the great augmentation in the consumption; and the price of wood would, at the same time, have kept within its due limits. In France, as in England, things have now returned to their natural order, except that the consumption has diminished. England now offers iron at 7*l.* per ton; and in France the production, which, in 1814, was computed at 800,000 or 900,000 *quintaux metriques*, has gradually increased to 1,500,000, of which nearly 500,000 quintals are wrought by means of coal. There is reason to believe that this production exceeds the consumption—the calculation being made upon the last three years. The inquiry of the commission shows that the price has already fallen 20 per cent. The use of coal is extending rapidly, and iron works are establishing in every direction, so that it has become a question whether, in a few years, the market will not be overstocked. Convinced that the production of iron in France is equal to the consumption, the commission are of opinion that foreign competition should not be invited, and consequently, that the present rate of duty should be maintained. In examining the question, they have come to the conclusion that the reduction of the duty on iron would not lead to a greater exportation of wine to the countries that produce iron. The wine duties in England have been recently reduced, and yet it has had but little influence on the quantity of wine imported there from France. But, although the commission consider that no reduction could be at present made without danger in the duty on iron, they are

of opinion that it would be advantageous to fix a period when a reduction could be made in proportion to the ameliorations that might reasonably be expected. They, therefore, propose that the present duty should be continued for five years—that at the expiration of five years the duty should be reduced one-fifth—and that after five years more, namely, in 1840, the Government and the Chambers should again take the question into consideration. The government approves this principle, but proposes that, in 1835, the duty should be reduced only one-tenth, and in 1838 another tenth—leaving, according to the recommendation of the commission, the duty upon its present footing till 1835, and the question for reconsideration in 1840. Relative to cast-iron, which, when brought by sea, pays a duty of 9f. per 100 kilogrammes, several founders are of opinion that the manufacture of France for machines and ornamental mouldings is far inferior to that of England. The commission, therefore, proposes to reduce the duty of 9f. upon cast-iron for the above purposes—the government proposes to reduce it to 7f. The government and the commission coincide in opinion that, with respect to cast-iron for the above purposes, the restriction which requires it to be of a certain form, and of a weight not less than 400 kilogrammes, should be done away."

The following Table, taken from the "Résumé des Travaux Statisques de l'Administration des Mines, en 1839," shows the quantity and other particulars relating to the make of iron in France, in the year 1838.

TABLEAU DES CONSOMMATIONS ET DES PRODUITS DES FONDERIES DE MINERAI, ET DES FORGES DE FRANCE, 1838.

Désignation des Groupes d'usines et des Départements faisant Partie de chaque Groupe.	Ouvriers.	Nombres.			Matières premières.		Combustibles.					Produits.		
		V. à Vapeur. H. Hydrauliques.	Nombres.	Force.	Minerai.	Fonte Brute (y compris une très-petite quantité de ferraille et de fonte mazée.)	Charbon de Bois.	Bois.	Coke.	Houille.	Tourbe.	Fabrication de la Fonte.	Fabrication du gros fer.	Fabrication de l'acier de forge.
					Poids. q. m.	Poids. q. m.	Poids. q. m.	Volume st.	Poids. q. m.	Poids q. m.	Vol. st.	Poids. q. m.	Poids. q. m.	Poids. q. m.
1. Groupe de l'Est	2026	V. H.	16 676	121 5650	1,676,197	404,549	1,111,358	135,065	920	48,147	..	527,354	301,245	4,209
2. du Nord-ouest ..	1879	V. H.	6 289	111 1831	785,278	182,547	628,631	..	..	65,522	..	274,197	121,149	..
3. de l'Indre	609	V. H.	3 107	48 845	311,658	66,356	278,916	..	..	..	..	106,696	45,961	..
4. du Périgord	1252	V. H.	1 401	6 2506	430,912	128,425	400,902	..	..	35,546	..	171,979	93,071	930
5. du Sud-est	135	V. H.	.. 80	.. 777	78,940	30,123	86,591	4,300	..	3,525	..	30,962	5,320	19,275
6. du Nord-est.....	2446	V. H.	4 476	60 3283	1,424,480	425,681	840,518	106,056	80,826	160,479	..	508,098	307,416	2,691
7. de Champagne et Bourgogne	3067	V. H.	7 521	247 3664	2,531,766	635,536	1,498,014	1,712	..	416,196	..	965,083	474,487	..
lu Centre......	2071	V. H.	30 320	604 1802	1,095,596	370,660	753,197	..	125,938	293,359	..	368,462	271,781	7,735
u Sud-ouest ...	439	V. H.	1 69	15 631	207,405	61,799	181,981	3,383	..	5,580	2883	82,065	42,526	..
des houillères du Nord ..	434	V. H.	13 8	517 215	166,391	149,126	..	..	117,071	243,559	..	48,419	107,332	..
11. des houillères du Sud	1301	V. H.	17 20	865 678	1,037,651	447,032	..	..	916,347	1,200,097	..	394,451	326,491	..
12. des Pyrénées et de la Corse	849	V. H.	.. 284	.. 5549	318,689	..	341,362	..	..	..	..	..	102,053	..
Totaux*....	16,508	V. H.	98 3251	2694 27431	10,064,963	2,901,834	6,121,470	250,516	1,241,102	2,472,010	2883	3,477,766	2,198,832	34,840
Valuer fr.†					13,915,940	52,011,077	45,094,733	1,447,276	2,853,680	5,049,464	4372	63,334,140	90,420,827	2,407,856

NOTES REFERRED TO IN PRECEDING TABLE.

* Le poids des produits et des matières premières a toujours été évalué avec l'unité de 100 kilogrammes, nommée *quintal métrique*. On emploie aussi une unité assez commode pour certaines évaluations: c'est la tonne de 1000 kilogrammes ou de 10 quintaux métriques. Le rapport simple qui existe entre la tonne et le quintal métrique rend très-facile la comparaison entre les deux sortes d'évaluations. L'unité employée en Angleterre diffère peu de la tonne de 10 quintaux métriques, et l'on peut, sans inconvenient, dans une foule de comparaisons générales, regarder ces deux unités comme identiques. Si l'on voulait toute fois comparer, d'une manière précise, les documents de ce résumé avec ceux qui ont été publiés sur L'Angleterre, il faudrait se rappeler qu'il existe, entre la tonne la plus usitée en Angleterre et le quintal métrique, les rapports suivants:—

1 tonne Anglaise=10.1464 q. m,
1 quint. métrique= 0.0985 t. a.

† Les valuers indiquées dans ce résumé sont toujours: pour les matières premières, leur valuer sur le lieu où elles sont élaborées; pour les produits, leur valuer sur le lieu où ils sont obtenus.

March, 1841.

Commerce of France.—The recent French papers contain a summary of the report laid before the Chamber of Peers, by M. Cunin Gridaine, the Minister of Commerce, from which it appears, that since the French government reduced the protecting duties on foreign produce, the trade of the country had increased considerably. Thus in the year 1829 the general trade of France, including the merchandise in the government stores, amounted to 616,000,000 francs, and the exports to 604,000,000f., and the foreign produce imported amounted to 483,000,000f., and the exports to 504,000,000 francs, whilst in 1839 the general trade amounted to 947,000,000 francs, and the exports to 1,003,000,000 francs, and the amount of foreign produce imported to 650,000,000 francs, and the exports to 677,000,000 francs. French navigation improved in a similar proportion with that of trade. The French tonnage in the year 1839 amounted to 647,000 tons, and in the year 1839 to 1,200,000 tons. Domestic produce increased in a similar proportion. The French coal mines produced but 17,000,000 of metrical quintals in the year 1829, and in the year 1839 they produced more than 30,000,000. "And what is still more remarkable," observes M. Cunin Gridaine, "this immense progress in domestic consumption was realised concurrently with the consumption of foreign coal, for the quantity of that article imported in the year 1829 amounted to 5,000,000 of metrical quintals, and in the year 1839, it amounted to 12,000,000. If," continues M. Cunin Gridaine, "from coal we pass to iron, we find that in the year 1828, France possessed 393 furnaces, producing 2,000,000 metrical quintals of cast-iron, and 1,295 furnaces for refining, manufacturing annually 1,500,000 metrical quintals of iron. At present France possesses 475 furnaces, which produce annually 3,477,000 metrical quintals of cast metal, worth 63,000,000 francs, and 1,500 furnaces for refining, which produce 2,241,000 quintals of iron, worth nearly 93,000,000 francs. Similar improvement is to be found," observes M. Cunin Gridaine, "in most of the domestic productions. Lyons has increased her silk looms from 27,000 to 40,000; and the exportation of silk stuffs, which in the year 1829 amounted only to 111,000,000, reached, in the year 1839, to 141,000,000.

No less remarkable has been the improvement in the woollen and cotton manufactures. The exportation of woollen stuff amounted in 1829 to only 30,000,000 francs, and increased in the year 1839 to 60,000,000 francs. And the export of cottons increased from 47,000,000 to 85,000,000 francs within the same period. The natural consequence," concludes M. Cuuin Gridaine, "to be derived from this increase of manufactures is the diminution in their price, which renders them more accessible to the mass of consumers. Bar iron, which ten years since sold at from 49 to 68 francs the 100 kilogrammes, according to the quality, now produces not more than from 35 to 50 francs at most. Woollen stuff, which sold at the same period at from 40 to 50 francs the piece, now brings only 25 francs; and calico, which in 1829 was sold for 80 centimes, is not now worth more than from 40 to 50 centimes."

CHAPTER XI.

UNITED STATES OF AMERICA.

During the war of the Revolution the commerce of the United States was interrupted, not only with Great Britain, but in a great measure with the rest of the world. The Americans were then compelled to depend almost entirely upon themselves for supplies, not only of arms and munitions of war, but of those articles of common consumption which they had previously imported from Great Britain and elsewhere. Those articles which their soil would not produce, or which they were unable to make, they were obliged to obtain at great risk and expense from other countries, or to be content without them. Encouragement was given to all the necessary manufactures, and the zeal, ingenuity, and industry of the people supplied the place of a foreign market.

At the close of the war, when the independence of the States was acknowledged, their commercial, as well as their political, situation was new, and they had many difficulties to encounter. During a contest of seven years their commerce was annihilated—shipping nearly destroyed, and public credit impaired—a general constitution for the American States was framed. They entered into a perpetual union, or confederation, with each other, for their mutual defence and advantage. They agreed that delegates should be appointed by each State, to meet in Congress on the first Monday of every year—that no State should be represented by fewer delegates than two, or by more than seven—that each colony should have a single vote—and that the laws and decisions of the Supreme Assembly should be obligatory on all the provinces under its juris-

diction. Each State, however, was to be governed wholly by its own legislature, and with the enactments of that legislature the Congress had no right to interfere. It was not difficult to perceive that this constitution had not within itself sufficient energy to produce and ensure a vigorous administration of affairs. The Congress had no authority over individuals—it had no power to force even the States to a compliance with its injunctions—and in case of any quarrel it could not prevent them from making war upon each other. Difficulties occurred, and distresses were multiplied on every side. The army, though disbanded, had received only four months' pay. The debts contracted by the Congress, as well as by many individual States, had not been discharged, and, therefore, were daily increasing; and the government possessing no revenue, could give no effectual value to its paper currency. Taxes were imposed by some of the provincial legislatures; but as they were far beyond the means of the inhabitants, and levied with the utmost rigour, they occasioned very general discontent; and though it had been fondly expected that, after the termination of the war, the commerce of the United States would revive, it was still embarrassed and languid. The vast influx of goods, also, drained the country of money, and some of the importing States levied duties for their own advantage.

In this situation all became sensible of the insufficiency of the general government, and of the necessity of vesting Congress with the power of regulating trade and commerce, and bringing into operation the energies and resources of the country for the general benefit. In consequence of a proposition from the State of Virginia, commissioners from that State, and from the States of Pennsylvania, New York, New Jersey, and Delaware, met at Annapolis, in Maryland, in September, 1786, to take into consideration the "trade and commerce of the United States—to consider how far a uniform system, in their commercial intercourse and regulations, might be necessary to their common interest and permanent harmony, and to report to the several States; such an act, relative to this great object, as, when unanimously ratified by

them, would enable the United States, in Congress assembled, effectually to provide for the same."

This report and address was sent to Congress, and to the several executives of States not represented at Annapolis; and, in consequence of the recommendation contained in the address, by a resolution of Congress, of 21st February, 1787, a general convention of the States, with the exception of Rhode Island, assembled at Philadelphia, and, after choosing General Washington for their president, they proceeded to the arduous duty which they had undertaken to perform:—"To take into consideration the situation of the United States—to devise such further provision as shall to them appear necessary to render the constitution of the federal government adequate to the exigencies of the Union," &c.

On the 17th September following, a new constitution was agreed upon, and by it the general government, among other important matters, were vested with power to "regulate commerce, and to levy duties, imposts," &c.

On the 4th day of March, 1789, the first Congress, elected according to the new institute, met at New York, having previously, by the unanimous voice of the provinces, elected General Washington to the chief magistracy of the American nation.

No sooner had this new form of government, with the father of his country at its head, begun to operate, than a new vigour seemed to be diffused through all the provinces. Trade and commerce revived—public and private credit was restored—a new spring was given to agriculture and manufactures—and new security afforded to the various pursuits of honest industry. The finances were arranged—the public debt was gradually reduced—a national bank, with a capital of 10,000,000 dollars, was established—the arrears due to the army were paid—a small permanent force was organised—the administration of justice was decisive, but equitable; and, though some disturbances arose on account of the taxes, or the way in which they were collected, yet the peace and prosperity of the colonies were, happily, secured.

From the establishment of the government the progress of

national, as well as individual, wealth kept pace with the increase of population; and, until the commencement of commercial restrictions, in December, 1807, and the declaration of war against Great Britain, in 1812, no nation, it is believed, had ever increased so rapidly in wealth as the United States. The well-known orders of the British council, and the Berlin and Milan decrees, almost destroyed American commerce. Great Britain declared France to be in a state of blockade, and the ports of Holland, with the whole Continent, from the Elbe to the Weser, as well as the ports of Italy and Spain, were included in this declaration. The British islands were declared to be in a similar state of blockade, and American vessels, bound to their coasts, were denationalised, confiscated, or burned on the high seas. England insisted that the United States should renounce all trade with the colonies of the enemy, from which they were excluded during peace, and prevent their citizens from trading with France, or with any powers adopting or acting under the French decrees; and all American vessels bound to any port on the Continent, from which the British flag was excluded, were seized and condemned. Those sailing to or from France, with American or French produce, were declared liable to seizure if they did not put into some British port, and then pay for permission to sail for the port of original destination. Under these declarations more than 900 American merchant-vessels were captured by the English in time of peace. On the other hand, France declared that the British islands, being in a state of blockade, all commerce with them was prohibited, and every American vessel bound to England or her colonies, or that paid a tax, or suffered a visit, was condemned as British property.

By the Bayonne decree, all vessels sailing under American colours were considered as British. American vessels destined for Sweden, Russia, and Denmark, were captured by Danish cruizers, and condemned in their courts, notwithstanding the most unquestionable evidence of their neutrality, and their destination to countries in amity with France—the ports of

which had been declared open to American vessels. In the ports of Naples American vessels were also sequestered.

American property, to the amount of 30,000,000 of dollars, was placed at the discretion of the Admiralty courts of England, and a still greater amount was submitted to the French Council of Prizes, or Council of State. In this situation an Act of Congress was passed, by which no vessel was allowed either to leave or enter her ports. This embargo was a necessary measure, to put an end to the seizure and confiscation of property—to recall the ships and seamen, and prevent them from being employed abroad in the licensed trade.

The distress felt in America, in consequence of these prohibitions, was very great: insomuch, that she made an attempt to regain, by an amicable settlement with France or England, the commercial freedom which she once enjoyed. To France she proposed to re-establish her commerce on such a footing, that Britain should not share in the benefit to be derived from it; and she hinted, that if the peaceful communication between the two countries should be interrupted by England, that then she would join in the war against her. To Britain she proposed, if she would agree to rescind her orders in council, to repeal her embargo, and also to shut her ports against France, provided France persisted in her hostile decrees.

France declared that the decrees of Berlin and Milan were repealed, but the American commerce in France was impeded in various ways. The introduction of colonial articles was prohibited, and vessels arriving with the productions of the United States were subject to exorbitant duties, tedious examinations, and forced exportations. Great Britain, therefore, doubted the fact of the repeal of those decrees, and refused to revoke or modify her orders in council, and the act of commercial non-intercourse was enforced against her.

The temper of the government in the United States, at the commencement of the year 1812, rendered it evident that nothing could prevent extremities with Great Britain, except the repeal, by the latter, of its orders in council, or a dread in

the former of entering into a very hazardous contest, with a prospect of much domestic discontent. The spring passed in the discussion of various measures of preparation by the Congress, in which the war party displayed a manifest preponderance.

An act for an embargo on all the shipping of the United States, for the term of ninety days from its date, passed the Congress in the beginning of April; the purpose of which was to expedite the fitting out of the American ships of war, and to prevent any more pledges from remaining in the power of an enemy on the commencement of hostilities. The result of the discussions in Congress was an act passed, on the 18th June, declaring the actual existence of war between the United States and Great Britain.

With the view of putting an end to the war, Russia, in August, 1813, had proffered her mediation, which was accepted by the United States, but declined by England. This power, however, afterwards proposed to treat directly with the American government; and, in consequence of this, the American plenipotentiaries, then at St. Petersburgh, repaired first to Gottenburgh, and afterwards to Ghent. Here, after some months of negotiation, a treaty was signed on the 24th December, 1814. In this treaty the parties mutually agreed that certain disputed boundaries should be settled by a commission—that peace should be made with the Indian tribes—and that the treaty should become binding four months after its ratification. On the original ground of dispute between the parties, nothing is said—the cessation of hostilities in Europe having changed the circumstances out of which the war arose; neither party felt itself under the necessity of discussing the claims for which it took up arms. The treaty, after being submitted to Congress, was ratified by the President, on the 17th of February, 1815.

We have thus briefly sketched the principal events connected with the declaration of war against Great Britain, as they were the immediate cause of the investment of capital, hitherto employed in commerce, in iron works, and other manufactures. To protect the capital thus invested, heavy

duties were fixed on the foreign manufactures, so that, at the present time, they amount almost to a prohibition of the English bar-iron.

The restrictive commercial regulations of Europe, and the late war with England, gave a great stimulus to American manufactures, and their progress during the course of a few years was almost incredible. Many new branches were introduced, and those which had been already established were carried to a much greater extent. The principal cause of the neglect of manufactures formerly, was the great profits afforded by agriculture, with the high price of labour. All the materials for manufactures are found in America. Fuel is inexhaustible; the ores of the most useful metals are in great abundance. In the year 1809, the Secretary of the Treasury unfolded the resources of the country, in relation to the raw material, and proposed various means for the promotion of manufactures—protecting and prohibitory duties, drawbacks, premiums, bounties, encouragement to new inventions, arrangements for facilitating pecuniary remittances, &c.

The immense capital which had been employed in commerce, previously to the restrictions, was transferred to manufactures, and workshops, mills, and machinery for the fabrication of various commodities, were erected as if by enchantment. Foreign artists and tradesmen were encouraged to settle in the country. The implements, tools, and even the furniture of emigrant mechanics, were made free of duty. In Pennsylvania such persons were admitted as freeholders on the day of their arrival, provided they declared their intention of becoming citizens within the time prescribed by law. A knowledge of machinery, and processes for the saving of labour, were communicated, through the daily journals, to all descriptions of people. Mineralogy became an object of attention, and every district was ransacked for useful minerals.

In 1810 the Secretary of the Treasury of the United States, presented to Congress a report on the manufactures, in which, amongst many other branches, iron, and the manufactures of iron, are mentioned as being firmly established—supplying, in

several instances, the greater, and, in all, a considerable, portion of the consumption of the United States.

The furnaces, forges, and bloomeries, of the United States amount to 530, of which the State of New York furnish sixty-nine. The annual value of iron and its manufactures was estimated by the Secretary of the Treasury (M. Gallatin) at 12,000,000 or 15,000,000 of dollars. The average value of imported metal, in bar-iron and steel, was 4,000,000 dollars. The Franconia Iron Works, in New Hampshire, established in 1810, employ a capital of 100,000 dollars. The Vergennes Iron Works, in Vermont, promise to be very important. The price of bar-iron at this establishment is 140 dollars per ton—the ore three dollars—charcoal four dollars and a half per 100 bushels: 19,000 muskets are annually made at the two public armories of Springfield and Harper's Ferry. There is now a considerable surplus of small arms.

Some of the ores of iron are found in every State in the Union; and, about the period of M. Gallatin's report, mines of this metal were worked in New Hampshire, Vermont, Rhode Island, New York, Connecticut, New Jersey, Pennsylvania, Virginia, and North Carolina.

MASSACHUSETTS—PRODUCTS.*

	Dollars.
37 forges—978 tons of bar-iron, value	121,980
440 ditto of anchors	92,712
2340 ditto of hollow ware	132,200
Wrought-iron	521,718
Edge tools	44,000
8 factories—19,095 muskets	229,085
36 ,, 5218 tons of wrought nails	69,235
2925 ditto of cut nails †	644,990
Small nails	1,360
11,000,000 tacks, or small nails	2,000
2777 dozen of steel thimbles	10,000
20 tons of manufactured steel	4,000

At Springfield, in the county of Hampden, the United States had an extensive establishment for the manufacture of

* In or about the year 1810.

† Mr. Perkins, of Newbury Port, invented a machine for cutting nails, by means of which 200,000 may be cut in a day.

arms; in 1810 the number of workmen employed was 220—the muskets manufactured were 10,240.

NEW HAMPSHIRE.—The iron works at Exeter produced sufficient iron for the consumption of the state.

VERMONT.—The iron works of Bennington county consist of a furnace and three forges. Those of Rutland of three furnaces, fourteen forges, and a slitting mill. In Addison county four forges, and in Chittendon two forges—which yield annually 1200 tons of bar-iron.

RHODE ISLAND.—As early as the year 1796, there were established, at North Providence, a slitting-mill, three anchor forges, and two machines for cutting nails, which have since greatly increased.

NEW YORK.*—Sixty-nine furnaces, forges, and bloomeries. In 1811 the bloomeries produced about 2000 tons of bar-iron. The product of cut nail factories (fifty in number) was valued at 300,000 dollars.

CONNECTICUT.—Iron ware, hollow iron ware, and other species of ironmongery, are made at Stafford, in sufficient quantity for the supply of the State. Iron works at Salisbury, Norwich, Stafford, and East Hartford. Several manufactories of nails, tinned plates, and iron wire. The manufactures have been valued at 250,000 dollars. At Newhaven an extensive manufactory of arms.

NEW JERSEY.—The iron works in the counties of Gloucester, Burlington, Sussex, and Morris, produce annually 1200 tons of bar-iron, 80 tons of nail rods, besides a quantity of hollow ware and castings.

PENNSYLVANIA.†—At Pittsburgh extensive manufactures of iron; also at Clarkesville, Brownsville, Harmony, and other places; a rolling and slitting-mill — three foundries. In Philadelphia ‡ several foundries — manufactories of steam-

* Fulton's first steam-boat was launched at New York the 3d Oct. 1807.

† In 1816 there were, in Pennsylvania, forty-four blast furnaces, seventy-eight forges, and 175 naileries.

‡ "The wire bridge, over the Schuylkill, near Philadelphia, is 400 feet in length, extending from the window of a wire factory to a tree on the opposite shore. The wires, which form a curve, are six in number, three on each side, and three-eighths

engines. Iron manufactories in Lancaster county, near Carlisle, at Fort London, and in Sherman's Valley, at Shippenburg, in Cumberland, Hanover, in York, and Merusburg, in Franklin. Value of manufactures of iron 5,869,487 dollars.

DELAWARE.—A considerable manufacture of iron on the Brandywine Creek. Wire also manufactured here.

MARYLAND.—Two iron works in Frederick county.

VIRGINIA. — The manufacturing establishments on the southern banks of Cullaway, Ross, and Balendine, produce each about 150 tons of bar-iron in a-year. There are forges of different kinds in Shenandoah and other counties, and part of the celebrated natural bridge is converted into a shot manufactory.*

OHIO.—Three furnaces, value 118,490 dollars. Twenty-four naileries, value 64,723 dollars.

INDIANA.—Nails manufactured 20,000 lbs., value 4000 dollars.

of an inch in diameter. The floor timbers, two feet in length, and one inch by three are suspended in a horizontal line by stirrups of No. 6 wire, at the end of the bridge, and No. 9 in the centre. The floor, of one inch board, is eighteen inches wide, and is secured by nails to the floor timbers, which are themselves fastened with wires. On each side three wires are stretched along the stirrups, with a board, six inches wide, to serve as a barrier for protection to passengers. The floor is elevated sixteen feet above the water.

The whole weight of the wire is....	1314	pounds.
Of wooden work	3380	,,
Of wrought nails................	8	,,
Total....	4702	

In good weather a bridge of this kind might be constructed in the space of two weeks, and the whole expense would not exceed 300 dollars.

"The Leheigh chain bridge, over the river of the same name, a mile below the borough of Northampton, is 475 feet in length—in two whole and two half spans or arches. It was finished in 1815. There is a double passage for carriages, with a footway of six feet between the middle chains, which are of 1¾-inch square bar-iron. Twenty tons of bar-iron were consumed in the work, of which the whole expense amounted to 20,000 dollars."—*Warder.*

* The armoury at Richmond furnishes 4000 muskets a-year, and, during the late war, it supplied the government with 300 pieces of cannon (twelve and six pounders) of which only one burst on trial. The legislature, in 1815, voted the sum of 100,000 dollars for the support of the armoury, and the establishment of four arsenals. At Harper's Ferry, the United States armoury, founded in 1798, employed 250 persons. In August, 1817, there were 20,000 complete stand of arms.—*Warder.*

KENTUCKY.—Four furnaces and three forges. At Lexinton four nail factories, making seventy tons of nails yearly.

TENNESSEE. — Six furnaces, value 98,077 dollars; six bloomeries, value 17,799 ditto; seven forges, value 110,438 ditto; seven naileries, value 128,236 ditto; guns, value 5845 ditto.

NORTH CAROLINA.—Iron works in Lincoln and Johnson counties, on the Yadkin River, in the counties of Guilford, Surry, and Wilkes.

SOUTH CAROLINA.—The first iron works, erected in 1773, were destroyed by the English during the revolutionary war, and rebuilt in 1783. On Allison's Creek, in York district, a forge, a furnace, a rolling-mill for making sheet-iron, and a nail manufactory. On Middle Tiger River are iron works on a small scale; also on the Enoree River and Rudy River, on the north fork of Saluda River, on George's Creek, and Twenty-six Mile Creek. In 1802 an air-furnace was erected on a neck of land between Cooper and Ashley Rivers, where good castings are made.

COLUMBIA.—About a mile beyond Georgetown, on the Potomac River, there is a cannon foundry. There are two boring-mills, situated near each other; in one five cannons are bored at the same time—in the other three. The streams which move the machinery are small, but the water falls to great advantage over an overshot wheel of twenty-nine feet in diameter. About thirty workmen are employed, chiefly emigrants from Europe. Foremen have two dollars, moulders one and a-half, and common workmen two-thirds of a dollar per day. The iron ore, of an excellent quality, is brought from the banks of the Potomac, near Harper's Ferry. It is rare that a gun bursts in firing it with a double charge. A cannon was cast at this foundry of 100 lbs. ball, to which was given the name of Columbiad. It requires two days to make a cannon, and two to bore it. The price is 50*l.* currency per ton.

At the town of Alexandria two manufactories of cut nails have been lately established.*

* According to the "Statistical Annals of the United States," by Adam Seybort

A commercial treaty between Great Britain and the United States was signed on the 3d of July, 1815, to remain in force during four years, according to which each country was to enjoy reciprocal freedom of commerce. No higher duties to be imposed than those which extend to all other nations, in relation to articles imported and exported; and the vessels which carry them to be subject to the same duties, and entitled to the same bounties.

Duties payable by law on all goods, wares, &c., imported into the United States of America, commencing on the 30th June, 1816:

Anchors	Drs. 1 50c. per cwt.
Arms (fire and side) and muskets	20 per cent. *ad val.*
Cannon	20 ditto ditto.
Iron or steel wire, not exceeding No. 18	5c. per lb.
Ditto ditto over No. 18	9c. ditto.
Iron sheets, rods and hoops	Drs. 2 50c. per cwt.
Iron bars and bolts, excepting iron manufactured by rolling	45c. ditto.
Iron bars and bolts, when manufactured by rolling, and on anchors	Drs. 1 50c. ditto.
Iron cast, and all manufactures of which iron is the material of chief value	20 per cent. *ad val.*
Nails	3c. per lb.
Spikes	2c. ditto.
Steel	Dr. 1 per cwt.
Steel manufactures, or of which steel is the article of chief value	20 per cent. *ad val.*

To meet the expenses of the war, the following rates were imposed on iron, the produce and manufacture of the United States, to commence on the 15th April, 1815:—Upon pig-iron one dollar per ton; castings one dollar and fifty cents; bar-iron one dollar; rolled and slit iron one ditto; upon nails, brads, and sprigs, and other than those usually denominated wrought, one cent per lb. In 1816 these duties were repealed.

founded on official documents, the manufacture of iron, in the year 1810, was as follows:—153 furnaces, making 53,908 tons of iron; 330 forges, making 24,541 tons of bar iron; 316 trip hammers; 34 rolling and slitting mills, which required 6500 tons of iron; 410 naileries, in which 15,727,914 lbs. of nails had been made. Manufacture of iron, value 14,364,526 dollars.

A statement of the duties which accrued upon iron, manufactured in the United States, from 18th April, 1815, to the 22d February, 1816, being the period during which those duties were in force:—

States and Territories	Iron. Dollars.	Cents.		Nails, brads, and sprigs. Dollars.	Cents.
New Hampshire..........	134	45	....	168	42
Massachusetts	2,753	48	....	21,209	18
Vermont................	584	82¼	....	1,007	16
Rhode Island	3	60	....	7	89
Connecticut	1,735	12½	....	1,154	21
New York	5,567	63	....	30,701	50
New Jersey	8,885	11	....	3,699	97½
Pennsylvania	27,941	20	....	31,876	87¾
Delaware	179	92½	....	868	38
Maryland	4,983	86½	....	9,368	95½
Virginia	4,982	86	....	1,800	47¼
North Carolina	762	06	....	229	73¾
Ohio	1,150	10¼	....	1,790	51¾
Kentucky	670	83½	....	877	51¾
South Carolina	285	25¼	....	38	08¼
Tennessee	1,267	48	....	610	81¼
Georgia	15	44	....	263	62
Mississippi territory	..		....	77	44½
District of Columbia	..		....	1,173	27
Total	61,903	23¾		106,924	12½

In the year 1818 an alteration was made in the tariff of the United States; and, again, in 1824, to come into operation on the 1st July of that year; and, in the year 1828, a still further alteration was made, particularly affecting British iron—it commenced on the 1st September.

The following table shows the rates of duty at the three periods:—

DESCRIPTION.	1818.	1824	1828.
IRON, on all manufactures of, not otherwise specified, or of which iron is a component material	Drs. 20 per cent. *ad val.*	Drs. 25 per cent.	Drs. 25 per cent.
— in bars or bolts, rolled	1 50c. per cwt.	Drs. 1 50c. per cwt.	37 per ton.
— in sheets, tinned	15 per cent. *ad val.*	15 per cent.	15 per cent.
— in bars or bolts, not manufactured in whole or in part by rolling	75c. per cwt.	90c. per cwt.	1c. per lb.
— round, or braziers' rod, of 3-16ths to 8-16ths of an inch diameter, inclusive, and on iron in nail or spike rods slit, and on iron in sheets, and hoop iron, and on iron slit or rolled, for band iron or casement rods	Drs. 2 50c. per cwt.	3c. per lb.	3½c. per lb.
— spikes	3c. per lb.	4c. ,,	4c. ,,
— nails, cut or wrought	4c. ,,	5c. ,,	5c. ,,
— tacks, brads and sprigs, not exceeding 16 ounces to the thousand	5c. per M.	5c. per M.	5c. per M.
— ditto ditto, exceeding 16 ditto ditto.	4c. per lb.	5c. per lb.	5c. per lb.
IRON, or STEEL WIRE, not exceeding No. 18	5c. ,,	5c. ,,	No. 14—6c. per lb.
— over No. 18	9c. ,,	9c. ,,	No. 14—10c. ,,
— on square wire, used in the manufacture of stretchers for umbrellas	Drs. 20 per cent. *ad val.*	Drs. 12 per cent.	Drs. 12 per cent.
IRON, OLD, fit only to be re-manufactured	15 ,, ,,	15 ,,	15 ,,
IRON, weights, with rings of wrought iron	20 ,, ,,	25 ,,	25 ,,
— pig	50c. per cwt.	50c. per cwt.	62½c. per cwt.
— hoops, made fit for use	Drs. 20 per cent. *ad val.*	Drs. 25 per cent.	Drs. 25 per cent.
— cables or chains, or parts thereof, and no drawbacks shall be allowed on the exportation of iron cables, or parts thereof	20 ,, ,,	3c. per lb.	3c. per lb.
— mill cranks and mill irons, of wrought	20 ,, ,,	4c. ,,	4c. ,,
— screws of, weighing 25lbs or upwards	20 ,, ,,	Drs. 30 per cent.	Drs. 30 per cent.
— screws of, for wood, called wood screws	20 ,, ,,	30 ,,	25 per cent.; if under 112lbs. 40 per cent.
— vessels of cast, not otherwise specified	......	1½c. per lb.	1½c. per lb.
— weights, and on all other castings of iron, not specified	......	1c. ,,	1c. ,,
— chains, except chain cables	20 per cent. *ad val.*	Drs. 25 per cent.	Drs. 25 per cent.
— cranks, except mill cranks	20 ,, ,,	25 ,,	25 ,,
— anchors	2c. per lb.	2c. per lb.	2c. per lb.
STEEL	Dr. 1 per cwt.	Dr. 1 per cwt.	Dr. 1 50c. per cwt.
— manufactures of, or which steel is a component part, not otherwise specified	Drs. 20 per cent. *ad val.*	Drs. 25 per cent.	Drs. 25 per. cent.

Previous to the settlement of the tariff of 1828, a committee was appointed by Congress to examine into and take evidence respecting the state of the home manufactures. The gentlemen examined with regard to the manufacture of iron were Messrs. Mitchell, Keese, and Jackson, and the following extracts are selected from their evidence:—

"Mr. Mitchell, of Bellefonte, Centre county, Pa., states, that in the counties of Mifflin, Huntingdon, and Centre, there are annually made 4000 tons of bar-iron, and of pig-iron and castings 8500 tons, from which the 4000 tons of bar are manufactured—the remainder is sold in pigs and castings. He estimates the sum total of iron annually manufactured in Pennsylvania at 21,800 tons of bar-iron, and 47,075 tons of cast metal, of which 37,200 tons are used in making bar-iron, and 14,365 tons castings—a part in air and a part in blast-furnaces; 100 tons of iron are converted into nails. Also, that there were as many forges built in 1820 as there are now, but were not all in operation; there were 450 tons more manufactured in 1827 than in 1820 (of bar-iron). Thinks the business will not increase, owing to the scarcity of timber. There may, perhaps, be an increase of 600 tons per annum.

"Mr. Keese states, there are manufactured in the neighbourhood of Lake Champlain 3000 tons of bar-iron.

"Mr. Jackson, of Rockaway, Morris county, New York, has a rolling-mill, in which he rolls iron into rods, from three-eighths to three inches diameter, and squares from three-eighths to an inch spike-nail rods, slit band iron, iron scrolls, &c. There is another large establishment of the same kind, said to roll 1000 tons annually—here are also made chain cables. Within a circle of thirty miles diameter there are eighty-one forge fires now in use. Each forge has two fires and one hammer. In the same circle there are also thirty forge fires abandoned, prior to 1818, owing to the low price of iron at that time. The quantity made in Morris, Bergen, and Sussex counties, is estimated at 2050 tons. Capital invested in 110 forge fires now in operation, 1,210,000 dollars; number of hands 5720—each fire capable of making twenty-five to thirty-five tons per annum."

EXPENSES OF MAKING IRON.

Mr. Keese exhibits a statement in detail of making seventy-five tons, viz. :—225 tons of rock ore at six dollars per ton—carting two: 37,500 bushels of coal, at four and half cents: bloomers' wages eighteen dollars per ton: labourer one dollar per day: mechanics three dollars per ton: insurance $1\frac{1}{2}$ per cent. on 2000 dollars: carting to Lake two dollars per ton: expenses to New York six dollars per ton: commissions 516 (on sales of seventy-five tons, at ninety dollars, 750 dollars): —Total, 6330 dollars. Exclusive of proprietor's time and attention—interest on capital. Requires forty hands.

Mr. Mitchell estimates the expense of making a ton of bar-iron from the pigs at seventy-five dollars, including the value of the pigs, 26 d. 67 c. All the bar-iron is made from pigs in this section. Mr. Jackson pays the bloomers for making a ton of bar-iron 16 d. 50 c., finding themselves. The coal costs 42 d. 50 c., and the three tons of ore twelve dollars. The petition from three counties of Jersey estimates the cost of a ton, and getting it to New York, at 79 d. 25 c.

Mr. Jackson estimates the expense of rolling a ton of bar-iron into iron, one inch square, at 14 d. 87 c., and it will lose in weight by the operation 3 per cent. on eighty dollars, making 2 d. 40 c.—Total 17 d. 27 c. Two tons a-day will constitute the average work, which yields a profit on rolling of 2 d. 73 c. per ton, equal to 5 d. 46 c. per day on an establishment worth 20,000 dollars. The expenses have not since increased.

QUANTITY OF IRON TO ONE TON OF BAR-IRON.

Mr. Mitchell states that 6000 tons of pigs will make 4000 tons of bar-iron, and it is sometimes a part of the contract with the workmen that they shall make it yield at that rate —one ton and a half of pigs to a ton of bars.

QUANTITY AND COST OF ORE TO ONE TON OF IRON.

Mr. Jackson—three tons of ore, at four dollars at forge.
Mr. Keese—ditto ditto, at six ditto ditto.

Mr. Mitchell—two and a half to three ditto, at five ditto ditto.

QUANTITY AND COST OF COAL TO ONE TON OF IRON.

Mr. Keese—500 bushels for converting the ore directly into bar-iron at the forge, without the intervention of a furnace, at four and a half cents.

Mr. Mitchell, in making a ton of pigs, 220 bushels, and in making a ton of bar-iron from pigs 175 bushels. Forge coal worth six cents at forge, and furnace coal five cents.

Mr. Jackson—800 bushels to make one ton of bar-iron from the ore; costs five cents per bushel. Coal from oak, chesnut, &c.

THE PRODUCT OF EACH FIRE.

Mr. Mitchell—generally 100 tons to each fining fire.

Mr. Jackson—Twenty-five to thirty-five tons each forge fire.

MARKET, AND PRICES OF IRON.

Mr. Mitchell—Pittsburgh is the best market for that which goes west, say 2 d. 3 c. Sometimes the iron masters go down the river with it. It costs from twenty-five to thirty dollars per ton to take it to Pittsburgh; the price there is from 100 to 115 dollars. A small part is sent to Baltimore and Philadelphia, where it sells at from eighty-five to ninety-five dollars per ton. Carriage to the former ten dollars, to the latter twelve.

Mr. Jackson sends to New York—costs 3 d. 75 c. per ton. Sells, on an average, at eighty dollars; rolled iron 100 to 110 dollars.

PRICE OF IRON AT THE WORKS.

Mr. Keese—bar-iron hammered from blooms eighty to eighty-five dollars per ton; small bars to order five dollars more.

Mr. Mitchell—bar iron, fixed price in barter or exchange, 100 dollars; pig-metal 26 d. 67 c., when bar is at 100.

Mr. Jackson—bar-iron from bloomery, worth, in 1825,

seventy-five dollars; 1826, eighty dollars; 1827, seventy-five dollars.

SUPPLY OF ORE.

Inexhaustible in the neighbourhood spoken of.

DUTY REQUIRED.

No protection is required for hoop, boiler, rolled, and slit nail and spike, rods; with this last a species of iron from Russia interferes, and requires to be placed on the same footing as nail-rods. Hammered bar-iron requires protection of about five dollars per ton. A duty is proposed on some kinds of rolled and slit iron and sheet-iron.

STEEL.

There are no facts stated respecting this article. The opinions entertained respecting the duty are various. Mr. Keese thinks it should be increased; Mr. Mitchell believes it would be injudicious, until it is ascertained whether the quality necessary for use can be made here; and Mr. Jackson conceives the duty is at present sufficient.

The settlement of the tariff of 1828, increasing an already high rate of protecting duties, gave great dissatisfaction to many of the States, and petitions were presented against it. In the subsequent pages, in speaking of the operation of the tariff, it must be borne in mind that the arguments apply equally to the manufactures of cotton and wool as they do to iron, but, of course, keeping strictly to the subject-matter of this work, they are here, as much as possible, confined to the manufacture of iron.

On the 5th January, 1830, Mr. Mallary, from the committee of manufactures, to which had been referred that part of the President's message which related to domestic manufactures, reported to the House of Representatives against the expediency of altering the existing tariff. The report stated that, in the opinion of the committee, the tariff had not had a fair trial, and that the fear of an alteration in the tariff had had the effect of preventing competition in those manufactures for the benefit of which it was laid.

"The committee give it as their decided opinion that it is inexpedient to make any change in the existing laws, 'intended for the aid and protection of domestic industry.'"

Early in the following month the committee of ways and means reported to the House "A Bill to reduce and modify the Duties upon certain Imported Articles."

"That from and after the 30th day of June, 1830, the following duties shall be levied, in lieu of those now imposed by law, on the following, amongst other articles, viz.:—

"On iron in bars and bolts, whether manufactured by hammering or rolling, ninety cents per 112 lbs.—provided that all iron in slabs, blooms, and loops, and other form less finished than iron in bars and bolts, pay duty accordingly.

"On iron in pigs fifty cents per 112 lbs."

The tariff men of every description, in the House of Representatives, joined in refusing all consideration to this bill—the votes being 107 against consideration to 79 in favour of it. This method of meeting a measure, introduced by a standing committee, on the recommendation, too, of the President, subject to the consideration of Congress, and putting it down without permitting argument or amendment, was without parallel in American legislation.

On the 8th February, 1830, Mr. Cambreleng, the chairman of the committee on commerce and navigation, submitted to the House of Representatives of the United States his celebrated report:—

"In 1807 the outrages of the two great belligerent powers made it necessary to commence a series of irregular restrictions on trade, which led to the war of 1812, and terminated finally with that contest in 1815. Previous to these political restrictions, from 1789 to 1807, our country presented a spectacle of prosperity which had never been surpassed by any nation in any age. We had been suddenly emancipated from a colonial condition—we had united the energies and resources of the States—we had not then learned to intermeddle with private employments—we had no heavy taxes to encourage smuggling, diminish consumption, and repress industry—we

had no stimulants but profit and enterprise—no guides but intelligence and judgment. We had, it is true, discriminations, minute and manifold, but, happily for the country, our imposts were moderate, our speculations harmless, and our trade was free. The succeeding eight years of restrictions and war checked the natural and rapid march of our industry, and drove us into employments new and unsuited to our age and condition. The peace of 1815 naturally restored us to our old occupations; and the sudden reaction of the tide of commerce swept away a large portion of capital which had been prematurely invested. Peace had not only returned, but the world had every assurance of its long continuance. The bloody wars which preceded the fall of Napoleon—the termination of his ambitious career—the revolutions of governments, and the critical condition of thrones, left Europe and her sovereigns in no disposition to embark speedily in new wars. We had before us the prospect of a long and general peace, and our policy should have been regulated accordingly. Our revenue laws should have been restored gradually, but decisively, to their condition previous to the war. Our policy, unfortunately, took another direction. The tariff of 1816 laid the foundation of all our subsequent errors, and we have now been engaged for fifteen years in an unprofitable experiment, to effect what embargo, non-importation, non-intercourse, and war, failed to accomplish. We have attempted, by the mere force of Congressional decrees, to resist the natural and salutary tendency of our industry to commercial and agricultural pursuits. We have been steadily sacrificing the commerce, navigation, and capital of New England, merely to bring forward new competitors in manufacturing, to embarrass our old and skilful artisans, and to ruin themselves. We have, from session to session, kept trade in such agitation and uncertainty, that the value of property could never be ascertained till the adjournment of Congress—and this we have called encouraging and protecting our industry. We have wasted millions of our ancient profits of commerce in a visionary experiment to increase our national wealth. In a legislative attempt to make ourselves more completely independent of foreign

nations, we have most effectually undermined the foundation of that naval power which can alone protect our country from foreign aggression.

"Your committee are as unwilling to agitate this question as they are little disposed to disturb the value of our national property. But when our commercial policy for the last fifteen years is candidly reviewed, they feel persuaded that the House will come to the conclusion, that, however harsh it may be, to reform the policy of a nation—its permanent welfare—its honour and its safety—may sometimes render it necessary to avoid the calamities which may result from an obstinate perseverance in bad measures. The regulations of our commerce and revenue now existing, not only put in jeopardy our national honour and safety, and the interests of agriculture and navigation, but they will be found, on examination, to be of the most unfriendly character to the largest portion of our manufactures. Whatever may have been the honest intention of those who framed our laws, they can have no other tendency than to increase our taxes, diminish consumption, destroy trade, and, however extraordinary it may seem, to draw premiums from American industry to encourage British manufactures, and to perpetuate their ascendancy even in our own markets. In making a last attempt to arrest the progress of measures so destructive to our national prosperity, we shall not allow ourselves to be intimidated by the rapid succession of our acts since the war; 'and, however willing they might be to leave the pliability of industry to accommodate itself, even to the worst of laws, it is impossible to view this question in any other light than as an unsettled one.' The late President of the United States, in his last message to Congress, most truly said, that 'our tariff was, in its details, not acceptable to any portion of the Union, not even to the interest which it was specially intended to subserve.' Our present chief magistrate expressly 'invites our attention to the existing tariff, believing that some of its provisions require modification,' and he solicits 'our particular attention' to the agricultural interest. With the approaching redemption of our public debt, he justly anticipates that 'our population will

be relieved from a considerable portion of its present burthens.' The committee, therefore, indulge the hope, that the political calm now existing will be wisely employed in devising and adjusting, in a spirit of mutual concession, some general plan which may relieve our industry from all unnecessary impositions—save our manufactures from capricious legislation and party vicissitudes—arrest the growth of unlawful trade, and give a fresh impulse to our commerce and navigation; and, above all, that we may, with patriotism, unite in our efforts to restore that good feeling which should always be cherished between the different sections of our Union.

"Our present tariff is, certainly, national in one respect—it is injurious to every interest and to every section of the country. Our manufactures, commerce, and agriculture may still slowly advance—for the energies of a young country may resist the repressing tendency of the worst of laws; but what would be the celerity of their march were we to reduce our duties on raw materials—our taxes on navigation, and our heavy burthens on agriculture? It would be some consolation to us if the taxes we have imposed upon ourselves had any tendency to give permanent encouragement to our own manufactures; but, unfortunately, the provisions of our tariff are so singularly and ingeniously contrived, that the only result of our taxation must be to perpetuate the ascendancy, even in our own markets, of the manufactures of Great Britain.

"We have imposed an enormous duty on the fine wools of England, Saxony, and Spain—while the British manufacturer, besides having his supplies uniformly cheaper, pays on all foreign wool only from a halfpenny to a penny per pound. We have deprived our hardware manufacturers of all chance of competition with their British rivals, by charging so high a duty on their raw materials; that, in many instances, the mere duty on the latter actually amounts to more than the entire cost of the foreign manufacture. Our manufacturers of cordage, also, are about to be driven from our markets under the operation of our own laws. Our tariff is nothing but a tissue of such absurdities. By no rule of calculation can we

ever expect that our manufactures can be permanently as cheap as foreign fabrics, while we persist in imposing enormous duties on raw materials, or higher imposts on the material than on the manufacture. Our existing revenue laws tend, inevitably, to perpetuate the manufacturing ascendancy of Great Britain.*

"Banishing the manufacture of cordage from our country is not the only injury we have inflicted on our navigation; we are actually destroying the trade of ship-building. The statement below † exhibits the comparative taxes on British and

COMPARATIVE STATEMENT OF DUTIES.

	Great Britain.	United States.
* "Iron in bars, per ton ..	drs. 6 66	drs. 22 40 per ton, and drs. 37 if rolled. This is a British manufacture.
" pigs "	2 22	12 50

"Our manufacturers of hardware generally, and our blacksmiths and iron founders, are in a condition most discouraging. They, of necessity, consume sheet, hoop, bolt, rod, and bar-rolled iron as raw materials. The Birmingham manufacturer is supplied with them at 30 drs. to 50 drs. per ton. Our duties vary from 37 drs. per ton to 3½ cents per pound, or 78 drs. 40 c. per ton, or from 123⅓ to 156⅔ per cent. *ad valorem*. In other words, the effect of our own law is to give a premium to the hardware manufacturers, blacksmiths, &c., of Great Britain, equal, on an average, to 55 drs. 70 c. on every ton of iron manufactured in that country for the use of the United States. The actual prices on these raw materials, in Great Britain, are 30 drs. to 50 drs., and in the United States 75 drs. to 180 drs. per ton. The duty on fifteen pounds of sheet and band iron, for fender plates, is 52½ cents.; on twenty pounds of sheet-iron, for grate pans, 70 cents.; on the manufactured article 18¾ cents.; on 100 pounds of sheet iron, for stove pipes, 3 drs. 50 c.; on the stove pipe manufactured 68 cents. The duty on hardware generally is 25 per cent., while the duties on the various kinds of iron used in manufacturing average about 140 per cent. *ad valorem*—giving more than 100 per cent premium to the British manufacturer.

"The American iron masters, &c., may see how effectually they are destroying our home market for their productions by perpetuating duties, which are actually nothing but so many premiums, drawn from the consumption of the United States, to encourage the manufacturers of Great Britain, &c. Our existing tariff, which is proclaimed to be for the encouragement of our manufacturers, is replete with such palpable absurdities. If we had all the capital and labour of Great Britain, our manufacturers would inevitably decline under the gradual influence of such laws." —*Report*.

† COMPARATIVE ADVANTAGES OF BRITISH AND AMERICAN NAVIGATION IN THE CONSTRUCTION AND FITTING OUT OF SHIPS.

"Duties levied in each country on the materials consumed in building and rigging a ship of 500 tons :—

American navigation. The incidental effect of our own policy is to give a premium of 1655 drs. 89 c. on every ship of 500 tons, built and fitted out in Great Britain."

BRITISH DUTY.

	drs.	cts.
If not 'copper fastened,' 20 tons of iron—say 7 tons Russian and Swedish, at 6 drs. 66c.	46	66
13 tons English—no duty.		
20,160 lbs. chain cables—say 9 tons, at the duty on iron, 6 drs. 66c.	60	0
4600 lbs. anchors.		
62 pieces heavy duck, 2356 yards		
20 ,, light duck 760 ,,		
3116 ,, at 7½d.	432	67
15 tons cordage, requiring 12 tons hemp, at 4s. 8d. per cwt.—say 20 drs. 74c. per ton	248	88
British tax on a ship of 500 tons	788	21

AMERICAN DUTY.

	drs.	cts.
If not 'copper-fastened,' 20 tons of iron—say 7 tons Russian and Swedish iron, at 22 drs. 40c.	156	80
13 tons English, at 37 drs.	481	
20,160 lbs. chain cables, at 3 cents	604	80
4600 lbs. anchors, at 2 cents.	92	
3116 yards duck,* at 10 cents.	311	60
12 tons hemp, at 60 drs.	720	
American tax on a ship of 500 tons	2366	20

American duty on 500 tons	2366	20
British duty on 500 tons	788	21
	drs. 1577	99
Add for increase on 3116 yards of duck, at 2·1-2 cents	77	90
Premium on every British ship of 500 tons	1655	89
For every hundred tons, American	473	24
* Add for the duty on duck, which is to be increased to 12·1-2 cents. per square yard	15	58
	488	82
For every hundred tons, British	157	64
Premium on 100 tons	331	18

—American and English chain cables are indiscriminately used in this country. It is immaterial whether we consume foreign or domestic hemp, iron, duck, or any of the above-mentioned materials; the price of the American, as well as the foreign, is enhanced in proportion to the duty.

Mr. Cambreleng followed up his report by bringing in a bill to amend the Navigation Laws of the United States, which was read twice:—

"Be it enacted, by the Senate and House of Representatives of the United States of America, in Congress assembled, that whenever the President of the United States shall receive satisfactory information of the existence of any law or decree of any foreign government, authorising the importation of the produce and manufactures of the United States into such foreign country, and all its possessions, at a rate of duty not exceeding 30 per cent. on the actual value thereof, and at such times as the produce and manufacture of that country may not be admitted into the United States on reciprocal terms; thereupon the President of the United States shall issue his proclamation, declaring that he has received such evidence, and, from and after twelve months from the date of such proclamation, it shall be, and is hereby declared to be, lawful to import into the United States the produce and manufactures of such country, and all its possessions, at a rate of duty not exceeding 30 per cent. on the actual cost or value, thereof," &c.

The effect of such an enactment would have been a virtual repeal of the tariff law, and the trade of Great Britain would have been the chief gainer by the change. The blacksmiths, and other manufacturers of iron, residing in Philadelphia, presented a petition to the House, praying that the duty on certain descriptions of iron might be so modified as to afford to them an adequate protection in their business: this petition was referred to the committee on manufactures, and ordered to be printed; an answer was drawn up by the committee to this petition, which it will not be necessary at this time further to allude to, as the substance of it is introduced in a subsequent petition. The tariff party were, however, too strong for the Chamber of Commerce, and also for the memorialists, and the act introduced by Mr. Cambreleng was not allowed to pass.

The rejection of this measure gave great dissatisfaction to the Southern States, and Mr. Blair, a member for South

Carolina, expressed himself in strong language on the subject; in substance he stated—"We (the people of South Carolina, and of the Southern States) do not wish to separate from the Union, if you will let us alone, and not impose oppressive laws upon us: but if you attempt to sacrifice our interests to the manufacturers of the Northern States,* we will separate from you, and, if necessary, we will defend our separate existence by force of arms."

On the opening of the next session of Congress (8th December, 1830), the President, in his message, said—

"While the chief object of duties should be revenue, they may be so adjusted as to encourage manufactures. In this adjustment, however, it is the duty of the government to be guided by the general good. Objects of national importance alone ought to be protected: of these the productions of our soil, our mines and our workshops—essential to national defence—occupy the first rank. Whatever other species of domestic industry, having the importance to which I have referred, may be expected, after temporary protection, to compete with foreign labour, on equal terms, merit the same attention in a subordinate degree."

The report of the majority of the committee on manufactures, to which had been referred this part of the President's message, was hostile to any alteration or modification of the existing tariff—the committee expressing their belief that "the tariff, having been so recently revised, any attempt to change its provisions, at this time, would spread alarm among the great interests of our country—shake confidence in the plighted faith of Government—destroy the supposed well-founded hopes of millions of our fellow-citizens—reduce them to penury, and expose the whole country to the dangers of a most selfish policy, which might be adopted by foreign nations."

The minority of the committee published a counter report, in which they took a view of the question, respecting the tariff, diametrically opposite to that taken by the majority.

In the mean time the opposers, as well as the supporters,

* Pennsylvania was among the most decided friends of the tariff.

of the existing tariff were not idle, and a petition of the iron manufacturers of Philadelphia* was presented to the Senate and House of Representatives, praying—

"1st. That all the existing duties on pig-iron, scraps, boiler

* The following is a recapitulation of the quantity of iron imported, in the shape of hardware, with the duty thereon, to which it is now subject, namely—

Hardware, subject to the duty of 25 per cent. *ad valorem*, in which the iron paid a proportional duty of 5 dollars 50 cents per ton	38,939½	tons.
Ditto, paying 35 per cent. duty, the iron paying 8 ds. 25c. per ton	6,289½	,,
Ditto, paying specific rates of duty, in which the iron pays 7 ds. per ton..........	2,579	,,
Tin, paying 15 per cent., in which the iron pays 12 ds. 50 c. per ton.	3,000	,,
Wire, paying from 6c. to 10c. per lb.	206	,,
Sheet, rod, hoop, and other descriptions of iron, paying 3½c. per lb...	1,167¾	,,
Bar-iron rolled, paying a duty of 37ds. per ton..........	3,332½	,,
Making the total of the above descriptions of iron, all manufactured by the process of rolling	55,514¼	,,
To which add the imported hammered iron	29,484	,,
Making the aggregate quantity of iron imported into the United States during the years 1828–29 amount to	84,998¼	,,
Of which amount there has been re-exported, in all forms	3,654¼	,,
Showing the actual home consumption of foreign iron to be	81,344	,,
Now, if to this amount there also be added the quantity produced in the United States, which, according to the estimates of iron masters, examined before the committee of the House of Representatives, in 1828, was 30,000 tons, but which an intelligent practical man, who travelled through the United States, for the express purpose of ascertaining the fact, as the result of the most careful inquiries, estimates at	35,000	,,
The annual consumption of iron in the United States, will be	116,344	,,

Of these 35,000 tons, produced in the United States, 10,000 tons only reaches the sea board; and, with the 81,344 tons of imported iron, makes the actual quantity passing through the hands of the dealers in iron on the sea board to be 91,344 tons, and 25,000 tons retained in the interior, there to be used. From this statement it appears that, of rolled iron, ten-elevenths were imported in the manufactured, and the remaining eleventh in the raw state; that the quantity of rolled iron, in all its various forms, compared with hammered iron, is nearly in the proportion of two to one; that the American manufactured bar-iron, which comes to the sea board, compared with the imported foreign iron, in all shapes, is in the proportion of one to nine, or out of 90,000 tons, only 10,000 tons; and that the American iron, compared with foreign iron, imported in the state of hardware, is in the proportion of one to six, or out of 60,000 tons only 10,000 tons; which last-named quantity, according to the statements of the iron masters, who were examined before a committee of the House

plates, and all other iron in loops, slabs, blooms, or any other state, but manufactured, and bar-iron, be abolished or repealed, and the importation on the same be admitted free of duty.

"2d. That all bar-iron, manufactured by hammering, be admitted, subject to the duty of April 27, 1816, on its importation, to wit, at the rate of 45 cents per cwt.

"3d. That all descriptions of iron manufactured by rolling, including bar, bolt, rod, sheet, and hoop, of every size and quality, be admitted, subject to a duty not exceeding that now imposed on the importation of hardware — namely, 25 per cent.

"4th. That wire of iron or steel, of all sizes and numbers, be admitted, subject to the same duty as the manufactures of wire now are, on their importation,—namely 25 per cent.

"5th. That the duty now imposed on railroad iron, when punched in the United States, be remitted, or a drawback of the existing duty be allowed thereon, on all sums exceeding 50 dollars.

"And, lastly, That the existing duties on steel be abolished or repealed, and the importation of the same admitted free of duty."

On the other hand, a numerous delegation from several States in the Union assembled in convention at New York, styling themselves the "Friends of Domestic Industry;" in an address to the people of the United States, they maintained the right of Congress to levy duties for the protection of manufactures as well as for revenue.

In furtherance of the objects of the convention, committees were appointed to inquire into the state of the home manufactures, and it was resolved that a committee be appointed to report on the production and manufacture of iron and steel. The committee consisted of members from Pennsylvania, New Jersey, Rhode Island, Maryland, New York, Connecticut, Massachusetts, and Vermont. They printed the following report, which contains a great deal of valuable information respecting the state of these manufactures :—

of Representatives, in 1828, included every description of iron brought from the interior to the sea board of the United States.

REPORT ON IRON AND STEEL.

"The committee on iron and steel respectfully report—

"That, in discharge of the duties assigned to them, they have availed themselves of the information obtained by the convention of the manufacturers of iron, recently assembled at Philadelphia (of which several of your committee were members), which information was originally collected for the purpose of answering the call made upon the Secretary of the Treasury at the close of the last session of Congress; and is, they have every reason to believe, as precise and accurate, in all its parts, as any body of facts, of equal magnitude and importance, which, under similar circumstances, has ever been submitted to the public.

"From abstracts of statements made to that meeting (annexed and marked A*), it appears that at 202 furnaces, known to have been in operation, there were made in the year 1830, 155,348 tons of iron. This iron, further investigation enables your committee to say, is converted into 90,768 tons of bar-iron, and 28,273 tons of castings, as there also set forth; which, with the bar-iron made at the bloomeries, amounting in that year to 5853 tons, and making a total of bar-iron of 96,621 tons, will, if estimated at the average wholesale prices of the principal markets of the country, as therein more particularly detailed, give an aggregate value for the production of that year of 11,444,410 dollars.

"The same statements exhibit, for the three years ending with 1830 (when the bar-iron made at the bloomeries is reduced to pig-iron, and added to that made at the furnaces), the following results:—

Years.	Iron.	Value.
For 1828	130,881 tons	10,861,440 dollars.
„ 1829	142,870 „	11,528,134 „
„ 1830	163,542 „	11,444,410 „

Increase in quantity in two years very nearly 25 per cent. Increase in market value not quite 5½ per cent.

"It will be perceived, in examining the last statement, that the increase in value does not keep pace with that of quan-

* Appendix D.

tity; and your committee would here, for a moment, call the attention of the convention to this fact, to which they shall have occasion to allude more particularly hereafter, as affording a practical refutation of the doctrine, that an increased impost necessarily enhances the price to the consumer.

"In this instance, the average price of bar-iron, in 1828, was 118⅓ dollars. In that year an addition to the duty on hammered iron was made of 4 ds. 40 c. per ton, and on rolled of 7 dollars. In the following year the price fell to 114⅔, and in 1830 to 96⅔—showing a decline in two years of 21⅔ dollars per ton, in the face of the increased duty above-mentioned—a decline effected exclusively by domestic competition, inasmuch (as will hereafter appear), no corresponding diminution of price took place abroad, and the fall here was greatest in those markets which are inaccessible to foreign iron.

In making these statements, your committee have been careful to found them upon data, which they believe will bear the test of the most rigid scrutiny. They have been particularly cautious to guard against exaggeration. They believe the cause they desire to sustain needs no aid beyond the simple truth; and, when that is made known, it will require no extraneous support, but may safely rest its claims to the favour of their fellow-citizens—upon their sense of justice and expediency, and its own intrinsic merits.

"Notwithstanding their own convictions on this subject—however satisfactory to themselves these statements certainly are—yet, as they are so much at variance with others, which, having been extensively spread before the public, under the sanction of a select committee of the Senate of the United States, are, on that account, entitled to the most respectful consideration, your committee will, in this place, submit some additional facts and statements, in proof of what they have already adduced.

	Tons.
In 1810 the quantity of bar-iron made in the United States was, agreeably to Cox's tables	27,051
This quantity was probably short of the truth, as the tables are known, when they err, to err in this particular, excess never having been attributed to them.	

	Tons.
We have no account of the quantity imported before 1816. It was then of all kinds of bar-iron, agreeably to a return made by the Register of the Treasury, upon a call by Congress, 21,537 tons. If the importation of 1810 be estimated at three-fourths of that of 1816, it cannot be far from the fact, and would be	16,152
Giving a total for the consumption of 1810, of bar-iron	43,203
Our population was then 7,000,000—it is now 13,000,000. If the consumption of iron be estimated at only the same rate, it would require for the year 1830	80,236
The importation of foreign bar-iron for 1829 (the last return in possession of the committee) was 32,750—exported 260—for consumption	32,490
Leaving a void to be supplied by the domestic article of......	47,746

"But if the consumption be estimated not only by the rates of increase of the population, but also by that of the vast increase of every branch of industry requiring the use of iron, it cannot be doubted that the consumption of 1830 was fully threefold that of 1810; it is probable that it was even greater, but equal at that rate to 129,609 tons, from which deduct that part imported, estimated as of 1829 (from which it cannot materially vary), and the result is 97,119 tons, instead of 35,000 tons, as asserted in the statements referred to—corresponding in a remarkable manner (the difference being less than 500 tons) with the estimates of the committee, founded upon the facts now collected, believed still to be under the truth, and showing the extraordinary errors into which the most enlightened and intelligent may be betrayed, by adopting the conjectures of others, without due investigation.

"Your committee have already referred to the fact of the decline in the prices of iron from 1828 to 1830, as establishing the doctrine that a duty on a foreign article, which can be abundantly produced at home, does not necessarily enhance the price to the consumer. In further illustration of that part of the subject, and of other beneficial consequences flowing from the system of protection, they beg leave now to refer to the accompanying statements marked B* and C.† By the one it will be seen, that while iron in some foreign markets advanced from 40 to 50 per cent. from 1824 to 1825, and from

* Appendix E. † Appendix F.

1822 to 1825 experienced fluctuations amounting to nearly 75 per cent. on the lowest cost, our own varied but about 17 per cent. including an additional duty of about 5, and actually receded, at a subsequent period, although sustained by a second addition to the duty, to prices below what had prevailed ten years before, when the existing duty upon hammered iron was but nine dollars, or less than one-half of that now levied.

"This comparative stability, so important to the success of all well-regulated industry, was due, exclusively to the domestic supply, which effectually protected the consumer from the foreign speculator, who could otherwise have controlled this market, and produced here the same disastrous consequences that ensued in his own.

"If such has been the result of protection upon the general market of the country, its effects have been still more striking, when examined with reference to particular, but most important, districts. Our western brethren, the hardy pioneers of our country, were restrained and limited in their contest with the wilderness, by the difficulty of obtaining, on almost any terms, this article, so indispensable to their success, in every stage of their arduous enterprise. The second statement exhibits the prices of iron of various descriptions at different periods, at Pittsburg and Cincinnati—the great marts of the west. Comment can scarcely be necessary upon the facts there disclosed. The decline in price (in some instances more than one-half) has been in exact proportion with the stability given to the domestic manufacture, by additional impost on the foreign, until it has reached a point that now enables the mechanics of the first mentioned city—that Birmingham of America—to enter into successful competition with those of almost any other quarter, in the fabrication of nearly every article of necessity, and in one justly esteemed the proudest effort of human ingenuity, they have attained a degree of perfection which enables them to challenge comparison with the skill and experience of any nation whatever.

"As your committee are assured that contracts can be made for any number of engines at the prices indicated in the

table referred to, it cannot be necessary that they should press this point further.

"Here your committee might, perhaps, leave this branch of their subject, satisfied with having, as they believe, demonstrated, that protection to the manufacturer, when effectual in amount, and connected with such an assurance of permanence as stimulates enterprise, and excites skill, does not operate as a tax on the consumer, but the reverse. But they believe that facts will justify them in going even further, and will enable them to maintain the position, that an impost may, under some circumstances, operate as a tax, not upon the consumer of the importing country, but upon the producer of the foreign article, compelling him, for the purpose of preserving even partial possession of the market, to reduce his own profits in proportion to the increase of impost, which reduction is, in fact, a contribution to the treasury of the importing country, and may relieve its citizens from the burthen of taxation to that extent.

"The circumstances under which this may occur are two. First, when the importing country is the only or the principal market for the article in question, and that article one which the exporting country unavoidably produces in the manufacture of some other of greater value. Second, where there is an increasing surplus of production in the exporting country, and an extensive and growing manufacture of the same article in the country where this surplus has, theretofore, sought a market.

"Without detaining the convention longer than to make a passing reference, as an example of the first case, to the additional duty laid by the tariff of 1828 (since repealed) upon molasses, which duty was exclusively laid by the foreign planter, who thus contributed, during its existence, more than half a million of dollars per annum to the support of the government of the United States, the committee will proceed, in proof and illustration, at once to the second, again to refer to statement marked B, and to that marked D,* where, among other facts, it will be seen, that in July, 1828, after the intelligence of our additional duty reached England, iron fell at

* Appendix G.

once 4 ds. 44 c. per ton, and that in the following year a further reduction of 6 ds. 50 c. was submitted to. Our additional duty gave additional confidence to the American manufacturer, he extended his operations, and increased the supply, without advancing the price. The foreign manufacturer could only reach the market by the payment of the additional impost. American competition prevented him from charging this to the consumer, and he was, therefore, compelled to diminish his profits by this much, and to the same extent to become a contributor to the treasury of the United States.

"An examination of the last-mentioned statement (D) will show that, by this means, through the instrumentality of American manufactures, their foreign competitors have been made tributary to the public treasury, upon the article of iron alone, since that article has been really protected, more than two millions and a half of dollars, while the consumer, as has been already shown, has been benefited to an amount even greater than this.

"If it be alleged that the same benefits would have resulted to the consumer—that the same decline in prices would have occurred without this competition—we answer, that such allegation would be contrary to all experience, which has taught all who have given attention to the subject, to know that, while we are dependent, exclusively, upon foreigners for any article of consumption, they are enabled to prescribe their own terms, and that these always include a large profit to themselves. But the moment it is discovered that domestic ingenuity is at work to produce the same article, that moment their prices are reduced—and often to an extent that excites astonishment—when it is accompanied with the knowledge that no sensible change in the cost of production has taken place.

"But, it may be asked—if additional protection, by exciting domestic competition, invariably brings down prices, of what benefit is this protection to the domestic manufacturer? To this we reply—that permanence and stability, not high prices, are our objects. American manufacturers are not so blind to the constant and inevitable course of events, as not to foresee that, as these objects are approached, they must expect a more active competition from their fellow-

citizens, as well those who are already engaged in the same pursuits, as from others who may be induced to enter. But for this they are prepared—they can calculate its extent, and its effects are wholesome and salutary upon all. It stimulates to greater care, economy, industry, and skill; profits are reduced, but they are stable; and the prudent man looks forward, with confidence, to realising a fair reward for his labours. Against foreign competition there is no guarding, because the manner of its approach can never with certainty be foreseen, nor can its extent be calculated. The ordinary production of foreign industry, in any particular branch, may be estimated with some accuracy; but the extraordinary fluctuation to which their markets are liable, from great political convulsions, and from other causes, cannot be estimated. Every violent change invariably forces upon our markets their vast accumulations, which easily breaking down the feeble barrier of a mere revenue protection, involves in ruin all who have essayed competition in the same branch. The consumer may be benefited for the moment, but a reaction certainly follows: great fluctuations engender a spirit of speculation, and mere gambling is substituted for all regular traffic. The frequent recurrence of these evils (every where acknowledged to be such) is only to be prevented by a system of protection, which, when efficient for the main purpose, is, as has been proved, abundantly so for this also.

"Having, as they believe, satisfactorily shown the beneficial effects of a system of real protection to the consumer of iron, your committee will proceed with a few brief remarks upon its influence on the agriculture, labour, and internal trade of the country.

"From a critical examination of the returns from seventy-three furnaces and 132 forges, in a great variety of situations, the details of which are more particularly stated in the paper annexed, and marked E,* they find that in the manufacture of the iron, in its first stages only, made in the United States in the past year, agricultural produce, to the amount of nearly three and half million of dollars, has been consumed; which

* Appendix H.

vast sum has been paid by the manufacturers, and those employed by them, to the farmer—showing how completely his interest is identified with theirs, and furnishing him with the means of estimating the probable consequences to himself of the destruction of this branch of industry, and the conversion of so large a body of consumers into cultivators and producers.

"By the same statement it appears that nearly 25,000 workmen are constantly employed, receiving annually the sum of 7,493,700 dollars—making, with their families, nearly 125,000 persons directly dependent upon this manufacture.

"For transporting this iron to the markets, where it is sold to the consumer, it is calculated that about one million and a quarter of dollars are annually paid—being a further contribution to labour and agriculture.

"These facts, your committee believe, sufficiently show how completely interwoven are the interests of agriculture and labour with those of manufactures. They think, and they hope hereafter to demonstrate it, that those of commerce are not less so; but, for the present, will refer to one fact, frequently alleged, and recently and triumphantly reiterated, in support of a different view of the subject—namely, that every ship, of the burthen of 500 tons, is subjected to a tax, occasioned by the duties on the foreign articles entering into her construction, of 2000 dollars—of which that on iron forms a large proportion. Without wishing to detract, in the slightest degree, from the merits of a branch of our industry that has secured so much of glory to our national character, as well as profit to our country, it must not be forgotten that this interest, which was one of the earliest subjects of national regard, has for a long period enjoyed a protection in the discriminating tonnage duty of 94 cents per ton, which, on a vessel of 500 tons, amounts to 470 dollars on every voyage; and, admitting the supposition that she makes three voyages yearly, such protection amounts to 1410 dollars per annum. And, inasmuch as it is understood to be a principle of mercantile calculation, that a new outfit is to occur every five years, there is a protection, amounting to 7050 dollars, against the tax of 2000; and if it be true that the community suffers by

protecting our domestic industry, it would seem not politic for those interested in navigation to appear as complainants. And this, it must be observed, is independent of the 10 per cent. discriminating duty on all merchandise imported in foreign bottoms imposed solely to foster the shipping interests of the country.

"It may be argued, that this system of discriminating duties is disappearing before the reciprocities offered and embraced in many of our commercial treaties. But, let it be remembered, that these reciprocities have been the fruit of a rigid adherence to the protecting system to which even the 'Mistress of the Ocean' has been obliged to succumb—affording a perfect illustration of the efficacy of those principles for which we contend, and which will eventually oblige the manufacturing nations of Europe, and elsewhere, either to extend the right hand of reciprocity to our agriculturists, manufacturers, and mechanics, as they have done to our merchants, or to sink before the unequal conflict with American ingenuity and American enterprise.

"The committee deem it here proper to advert to the attempts which have, for some two years past, been made to array the interests of the manufacturers of iron, in its higher stages, to wit, hardware, &c., against its primary manufacturers, and the efforts which have accompanied these attempts to obtain a large reduction of the existing duties upon some descriptions of iron, and a total abolition of those upon others, for the alleged purpose of placing those two branches of industry upon an equal footing in the home market.

"Fully to counteract such efforts, your committee believed it would only be requisite to ascertain what proportion of the value of the manufactured article consisted of the duty on the bar and sheet-iron entering into its composition; and what, of that, upon the value given abroad by the subsequent elaboration. To determine this, they took a lock, called a Scotch spring-lock, which weighed two pounds—they supposed that half a pound of iron was lost in making—total weight two and a half; deduct half a pound of brass—weight of iron two pounds, which at the highest duty of 3½ cents

per lb., is 7 cents. The stirling cost of this lock, with charges subject to duty, was 23 pence, and the duty, as calculated at the Custom-house, very nearly 12 cents.

" In this case, if the American manufacturer of locks had imported his iron at the highest rate of duty, he would have paid a tax (if the duty be a tax) of 7 cents. and would have received a protection of 12 cents, as against the foreign manufacturer of hardware.

" Another lock, called a closet lock, cost, with charges, 2*s.* 3*d.*; duty, as above, nearly 14 cents, and weighed, with the same allowance, three-quarters of a pound—duty, at the highest rate of 3½ cents, is 2⅝ cents. Here the manufacturer of hardware would receive five times more protection on the same article than the iron manufacturer.

" A third lock, called a mortice lock, cost, with charges, 5*s.* —duty, as above, 30 cents, and weighed, with the same allowances and deductions for brass, two pounds, which, at the highest rate of duty, as before, is 7 cents.

" Here the protection to the hardware manufacturer, as compared with the iron maker, is nearly four and a half to one. In all these cases the highest duty is taken on iron and the lowest on hardware.

" The inquiries of the committee having, so far, exhibited results so entirely at variance with statements which had been widely circulated, under high authority, they became apprehensive that it would be alleged these examples had been purposely selected with reference to such result; and although they were, in truth, taken entirely at random, yet they believed it to be their duty to pursue the investigation on a more extended scale, and, if possible, to embrace the entire importations of the country—a course, the perfect fairness of which, they think, cannot be called in question. It was known to one of your committee that, when the applications already referred to were before Congress, a highly respectable house, of this city, engaged both in the manufacture of iron and importation of hardware, had taken up the memorials and statements upon which the subsequent report of the select committee of the Senate was founded, and examined

them in detail. They were, accordingly, invited by the committee to assist them in the investigation; their aid was cheerfully and promptly furnished, and the result will be found in the document annexed, and marked F.*

"To refer particularly to every part of this elaborate and most valuable paper, would occupy too much of the time of the convention, and would swell this report beyond all reasonable limits. Nor could justice be done to it by any reference, however particular. It is respectfully, but earnestly, recommended to the careful perusal of every member.

"Your committee, however, solicit the attention of the convention to a few remarks upon some of the most striking errors of fact contained in the memorials, statements, and report already alluded to, which they deem too important to pass without such notice.

"One great object of the memorialists was to obtain the importation of English iron at a very low rate of duty, on the alleged ground that it was superior to other iron for many, and equal for most, purposes for which iron is used.

"In answer to this, it is shown that, although this iron can now be imported in every required form of bolts and bars, at full 20 per cent. less than other iron, yet such is the character which experience has stamped upon it, that only one-seventh of all the iron imported is of this kind, and of the entire consumption it forms but one thirty-ninth part. To admit the statement of the memorialists, in this respect, to be true, would, therefore, be to suppose an ignorance of their profession and interests, on the part of the American blacksmiths and others, workers in iron, which your committee cannot for a moment sanction.

"The memorialists stated that the duty on iron was from 159 to 282 per cent., or from six to eleven times the duty on hardware. The want of candour manifested by the general character of this statement, is fully exposed in the examination, where it is shown that the quantity paying the duty of 37 dollars per ton, is but one-seventh, and that paying 78 drs. 40c., but one-thirtieth of the whole importation, and but 1-39th and 1-112th parts of the entire consumption.

* Appendix I.

"Your committee have already had occasion to advert to the extraordinary error committed by the memorialists, when they fixed the manufacture of iron in this country at 35,000 tons. They now beg to call the attention of the convention to an error as remarkable on the other hand.

"For the apparent purpose of exhibiting, in mortifying contrast the insignificance of the domestic manufacture, when compared with the foreign importations, the entire consumption is assumed at .... 116,344 tons,
Leaving, after the deduction of the above .... 35,000 „

To be supplied from abroad the quantity of .. 81,344 „

"Of this last quantity it is stated 'that 47,798 tons were imported in the form of hardware, at a duty varying from 5·50 to 8·25 per ton, and that, in this way, this large quantity of iron was introduced, at an aggregate duty of .... $284,293\frac{11}{100}$

'While the same weight of iron, imported in its raw state, of bar, sheet, rod, or hoop iron, estimating the duty at only 37 dollars per ton, and leaving out of consideration the duty of $3\frac{1}{2}$ cents, would have paid........ 1,568,526

'At this rate,' they say, 'the discriminating duty in favour of the British manufacturer (of hardware) was actually $1,284,232\frac{83}{100}$ dollars for the fiscal year 1828-29.'

"The above weights, it is admitted, are obtained by estimates—that is, by assuming one-third of the gross value of the hardware imported to be the cost of the raw material of iron, and then bringing that third into tons, at 23drs. 33c. per ton. The experiments, on a small scale, already recited in this report, showed the error of these estimates. When brought to a practical test, on a scale embracing every article in the whole range of importation, their true character was made even more manifest. The committee again refer to the examination of Messrs. Green and Wetmore, by which it will appear that the whole weight of the above hardware (including brass, horn, and all other materials) was but 9763 tons,

instead of 47,798 tons, and that the duty actually paid was rather more than 104 dollars per ton. That, if the American manufacturer of hardware had imported the iron and paid the duty mentioned by the memorialists, of 37 dollars per ton, he would have paid the sum of .... 361,231 dollars,
and would have been protected by a duty on the manufactured article of .... 1,003,843 „
Making a discrimination, for the fiscal year 1828-9, in favour, not of the British manufacturer of hardware, of 1,284,232 drs. 83c., but in favour of the American manufacturer of hardware—over both the British hardware manufacturer and the American manufacturer of iron, of 642,612 drs.

"Here your committee might, they believe, safely rest this part of the subject, deeming their duty in relation to it fully discharged. They will detain the convention only while they present a brief summary of the different, and, in some instances, opposite conclusions, to which a careful examination of the same subject has brought them, when compared with those put forth by the memorialists.

"They (the memorialists) say that the entire consumption of iron in the United States is..........	116,344 tons,
"Your committee have shown that, in domestic and imported bar-iron, taking the imports (with the exception of hardware) as stated by the memorialists themselves, and in castings, it amounts to	158,280 „
"If the estimates of the memorialists, as respects hardware, had been retained, the quantity would have been swelled to....	196,315 „

instead of 116,344, and it is with reference to that quantity that the comparison of statements should be made.

"The memorialists say that, of this quantity consumed, but 35,000 are made in the United States.

"Your committee have shown that, of bar-iron, there is produced................	96,621 tons,
"And of castings......................	28,273 „
Together	124,894 „

but if reduced to pig-iron, the mode of computation always adopted in Great Britain, the quantity would rise to 163,542 tons, instead of 35,000.

"Of the quantity made here, the memorialists say but 10,000 tons reach the sea board.

"Your committee, upon what they deem good authority, believe that one-third of all the bar-iron, and more than two-thirds of all the castings, pass through the markets on the sea board: they shall have occasion to notice this item more particularly hereafter. For the present, they will only remark, that more than 10,000 tons are annually made in New Jersey alone—all manufactured within a few miles of the sea board, and nearly all sent to the markets there.

"The memorialists say that, of rolled iron, ten-elevenths are imported in the manufactured state, and the remaining eleventh in the raw state.—Your committee have shown that the actual proportions are a little more than two to one, instead of eleven to one.

"They say that the quantity of rolled iron, in all its various forms, compared with hammered iron, is nearly in the proportion of two to one—Your committee show that the true proportion is but a little more than one to nine.

"They say that, of 90,000 tons of iron sold in the markets of the sea board, but one-ninth, including all descriptions, is American.—Your committee have shown that, of about 95,000 tons sold in those markets, about 52,000 tons, or four-ninths, are of American manufacture.

"They say that the American iron, compared with foreign iron, imported in the shape of hardware, is in the proportion of one to six, or out of 60,000 tons but 10,000.—Your committee have shown that the true proportions are, as nearly as possible, the reverse—namely, as six to one, or but 9763 tons, imported in hardware, against 52,000 tons American, brought to the sea board.

"The memorialists allege that 47,798 tons of iron, in the form of hardware, were imported in one year.—Your committee have shown that the real amount was 9763 tons.

"The memorialists assert that the duty on iron is from six

to eleven times that on hardware.—Your committee show that the duty on hardware is three to four times that on the iron entering into its composition, even if that duty be estimated at 37 dollars per ton, which is 11 dollars per ton more than the average rate.

"The memorialists assert that sheet-iron, in the form of tea-trays, can be introduced at a cost of 83 drs. 72c. per ton.—Your committee show that the true cost is 396 drs. 22c.

"They assert that but 11,000 persons are employed in the United States in the manufacture of iron.—Your committee have shown that the number is nearly 25,000.

"Finally, the memorialists complain of the oppressive burthen which the protection afforded to this inconsiderable quantity, as they call it, of American iron, has been to them in their business. To show the extent of this burthen, they had previously asserted that the existing laws had operated, in a single year, in favour of the British manufacturer of hardware over the American, to the amount of 1,284,232d. 83c.—Your committee have shown that the actual discrimination in favour of, not the British, but the American manufacturers of hardware, that is, of all of the petitioners themselves who are such, in that same year, at the lowest computation, very nearly 650,000 dollars.

"Your committee earnestly invite every practical American mechanic to examine this subject for himself—to look well into their statements, and ascertain to what extent his interests are guarded by existing laws; and having done so, they cannot doubt an unanimous opposition on the part of that repectable and valuable class of our citizens, to any such suggestions as those embraced in the concluding prayers of the memorialists, which have been under examination.

"Your committee feel that they ought to apologise for having occupied so much of the time of the convention in the examination of this memorial, which might be thought not strictly within the range of their duties. It would seem that errors of such magnitude must be self-evident, and could require no exposition. Your committee would willingly have adopted this opinion, but the importance that had been given

to this document, by the course pursued in the Senate of the United States, forced them to a different conclusion. In that venerable body it was referred to a select committee of its most distinguished members—a majority of whom, by adopting all its statements as facts, and its opinions and arguments as just—reaffirming them, indeed, after they had been questioned in counter-memorials—have thereby changed their character—have lent to them the high authority of their names and station, and stamped them with an importance which they did not originally possess. They have been widely and industriously circulated under the imposing sanction of a report of the Senate, and so much have they been relied on, that it has been triumphantly asserted they would 'break the iron arch' which supports our system, and thus bring the whole fabric to the ground.

"These were the considerations that governed your committee in the course they have pursued, and they hope to find in them a sufficient excuse for their trespass upon the time and attention of the convention. In the performance of this duty, they have found it impossible to be brief, where so many assertions were to be met and refuted—this was out of the question. The same allegation met them again and again, in some new form, varied to suit the occasion—hence repetition was unavoidable. They trust their apology will be found in the necessity of their situation.

"Before dismissing this subject, your committee owe it to justice and themselves to say, that they entirely acquit the distinguished gentlemen, composing the majority of the committee of the Senate, of even a suspicion of any intention to mislead. They cheerfully concede to them the same sincerity and singleness of motive and purpose which your committee claim for themselves; while they regret, as they do most deeply, that they should have been made the instruments of so extensive a dissemination of error.

"In the preceding examination, your committee had occasion to notice and refute the statement, that but a small portion of American iron reached the markets on the coast. In a communication, addressed to the convention, recently

assembled in a neighbouring city, which derives importance from having been adopted by that respectable body as a part of its proceedings, it is, among other things, asserted, that but 430,000 dollars, in value of all the iron manufactured in this country, including duty or bounty, reaches the sea board. The presumed object of this assertion, as well as those in which the quantity was stated at 10,000 tons, is to make it appear that the abolition of the duty on foreign iron would affect but a small number of the manufacturers of the domestic article, while it would relieve the mass of the consumers on the sea board from the supposed tax upon the foreign.

"To show the value of this assertion, your committee beg leave to refer again to statement A, where it will be seen that, in a small district of West Jersey alone, iron, amounting to more than half a million of dollars, is annually made—the whole of which finds a market in the neighbouring sea-ports.

"Your committee were instructed to report upon cutlery, and the manufactures of iron in its higher stages.

"They have found it impossible, in the limited time allowed them, to do more than ascertain that they are numerous, and of great extent and value. They annex two statements, marked G* and H†—the one exhibiting the annual amount of manufactures in a single county of Connecticut, the value of which is nearly 1,900,000 dollars; iron constituting one-fourth, and those of that material, in its higher branches, nearly one-tenth. The second shows the value of manufactures, for one year, in the small county of Delaware, in Pennsylvania, amounting to nearly 1,400,000 dollars, of which those of iron form more than one-seventh. These two instances, taken at random, may serve to convey some idea of the vast amount and value of the manufacturing interest of the entire country.

"The committee have deemed the article of steel of sufficient importance to merit a distinct report, which will be found annexed, marked I,‡ and is respectfully recommended to the particular attention of all those who take an interest in that valuable branch of our industry.

"The last consideration that occurs to your committee, as

* Appendix K. † Appendix L. ‡ Appendix M.

properly within their duty to notice, is the capability of the United States to furnish a supply of iron equal to their own wants. Of this the committee cannot entertain the smallest doubt. The tabular statements, heretofore referred to, show that, in two years, from 1828 to 1830, the supply has increased very nearly 25 per cent.; and it is known that old establishments, in many situations, are enlarging, and new ones erecting—giving assurance that this increase will be progressive, until not only the domestic market will be fully supplied, but a surplus remain for exportation—creating thereby a new source to meet the demands of foreign commerce, and additional means of employment for our navigation.

"If we compare our situation with that of Great Britain, in this particular, less than a century ago, we shall see abundant reason for self-gratulation. Ninety years since, her entire production of iron did not much exceed that which is now made in the State of New Jersey. In 1802, within the limits of a single generation, her furnaces were less in number than those now existing in the United States; and their production not more than will be made here during the present year—and this without availing ourselves of the means to which she is indebted for the extraordinary change which this comparatively short period has effected. We have the benefit of her experience—we can command her skill, if it be necessary—we have the mineral fuels, which have done so much for her, in unlimited abundance, when our forests fail—our citizens yield to none in enterprise and ingenuity, when adequate rewards for the exercise of those qualities are held out—and, knowing this, with the experience of our rapid progress in the last two years, furnishing, as we now do, more than three-fourths of the entire consumption—is it, we repeat, extravagant to assert, that we are fully competent to supply our own wants, and furnish a surplus to minister to those of our neighbours?

"In conclusion, your committee cannot refrain from the expression of the gratification which the result of this investigation has afforded them. Deserted by the Government, and denied that protection which, at the close of the late war, was

freely granted to almost every other interest—this important branch of domestic industry, so essential to the prosperity, if not to the existence, of all others, and so closely allied to real national independence, seemed threatened with absolute extinction. A wiser policy, adapted to a later period, aided by the unconquerable spirit of American enterprise, has raised it from comparative insignificance to the elevated rank it now holds; and to maintain it in which, it asks, as it believes, no sacrifice from its fellow-citizens engaged in other pursuits. Grateful for the consideration which its well-founded claims upon their justice, after years of delay and suffering, at last obtained, it is now returning to them the full measure of benefit, which it has received at their hands, and will continue to protect them, as heretofore, from speculation and monopoly from abroad—should it not a second time become the victim of that unnatural policy, which cherishes foreign, while it neglects and destroys our native industry.

"By order of the committee,

"B. B. Howell, Secretary."

SUPPLEMENTAL REPORT.

"Before separating, the committee instructed the secretary to make a further report, of any facts that might be received in time, for the permanent committee. In conformity therewith, he has now to state, that Mr. Peter Townsend, who was delegated by those engaged in the manufacture of iron in this city, to visit all the establishments in this State, and those east of it, has returned, and reported the result of his examination; by which it appears that, in New York, there are in operation, of blast furnaces, not included in the estimates of the above reports, 8; in Connecticut, 3; and information from various other places enumerates furnaces, not before known, to the number of 26; in the whole, 37 additional furnaces, making, of pig-iron and castings, 25,250 tons, and a large number of forges employed in converting the pig into bar-iron.

"There are returns also of thirty-two bloomery fires, in situations where it was not before known that any existed—

making thirty tons each per annum, or nearly 1000 tons yearly of bar-iron by this process; and the returns brought by Mr. Townsend show that the committee estimated this kind of iron nearly 1000 tons too low in the districts which he visited.

"The result of the whole would be, if 20,000 tons of the above pig-iron be converted into bars—

Bar-iron	14,285	tons.
Bloomed bar-iron, as above	1,960	"
Bar-iron, per former statements	96,621	"
Total of bar-iron made in the United States, agreeably to the information received by the committee to this date	112,866	"

"Stated in pig-iron, it would be—

Former statement	163,542	"
Pig-iron and castings, as above	25,250	"
Bloomed bar-iron, equal to	2,744	"
Total of iron equal to pig-iron	191,536	"

"The value of which, according to the mode of estimation already explained, would be 13,329,760 dollars.

"It is hardly necessary to add, that these additional facts strengthen all the inferences and calculations heretofore made by the committee.

"B. B. Howell, Secretary.

"*New York, November*, 1831."

No alteration in the tariff was made until the succeeding session, when an Act was passed, and approved by the President, on the 14th July, 1832—"That from and after the 3d day of March, 1833, so much of the Act, entitled 'An Act in Alteration of the several Acts imposing Duties on Imports,' approved the 19th May, 1828, as is herein otherwise provided for, shall be repealed."

The following are the rates of duty fixed on iron, &c.:—

DESCRIPTION.	drs.	cts.	
Iron, in bars or bolts, not manufactured in whole or in part by rolling; also all iron in slabs, blooms, loops, or other form, less finished than iron in bars or bolts, and more advanced than pig-iron, except castings	0	90	per 112 lbs.

1

	drs.	cts.
Iron, bar and bolt, made wholly or in part by rolling........	30	0 per ton.
,, in pigs	0	60 per 112 lbs.
,, cast, vessels of, with or without appendages of wrought iron—such as handles, hoops, &c. (not otherwise specified)	0	1½ per lb.
,, all other castings of (not otherwise specified)..........	0	1 ,,
,, round, or braziers' rods, of 3-16 to 8-16 of an inch diameter inclusive, and on iron in nail or spike rods, or nail plates, slit, rolled, or hammered, and iron in sheets, and hoop-iron, and on iron, slit, rolled, or hammered for band-iron, scroll-iron, or casement rods	0	3 ,,
,, scrap, or old....................................	12	50 per ton.
,, manufactures, or of which iron is a component part (not otherwise specified)	25	per cent. *ad val.*
,, manufactures of, partly finished, same as entirely finished	25	,,
,, or steel wire, not exceeding No. 14	0	5 per. lb.
,, Ditto exceeding No. 14	0	9 ,,
,, square wire, used for the manufacture of stretchers for umbrellas, and cut in pieces, not exceeding the length used therefore..................................	12	per cent. *ad val.*
,, spikes	0	4 per lb.
,, nails, cut or wrought	0	5 ,,
,, tacks, brads, and sprigs, not exceeding 16 oz. per M....	0	5 per M.
,, Ditto ditto exceeding 16 oz. per M.	0	5 per lb.
,, anvils and anchors, and all parts thereof, manufactured in whole or in part.............................	0	2 ,,
,, cables or chains, or parts thereof, manufactured in whole or in part	0	3 ,,
,, mill cranks and mill irons	0	4 ,,
,, mill saws	1	0 each.
,, blacksmiths' hammers and sledges	0	2½ per lb.
,, axes, adzes, hatchets, drawing knives, cutting knives, sickles, or reaping hooks, scythes, spades, shovels, squares of iron or steel, steel yards, scale beams, socket chisels, vices, screws, &c.	30	per cent. *ad val.*
,, all articles manufactured in whole of sheet, rod, hoop, bolt, bar-iron, or of iron-wire, or of which sheet, rod, hoop, bolt or bar-iron, or iron wire, shall constitute the greatest weight, and which are not otherwise specified, shall pay the same duty per lb. that is charged on sheet rod, hoop, bolt or bar-iron, or iron-wire, of the above number respectively, but the duty in no case to be more than	25	,,
Steel..	1	60 per 112 lbs.
,, manufactures of, or of which steel is a component part (not otherwise specified)	25	per cent. *ad val.*

This alteration in the tariff was far from being satisfactory to the State of South Carolina, which persisted in opposing these laws, on the ground that it was unconstitutional to impose taxes for the purpose of protecting particular interests. They called a convention of the State, for the purpose of declaring the tariffs of 1828 and 1832 null and void within its limits; and this was not only done, but the Legislature was directed to pass laws prohibiting the collection of duties, and punishing any person who shall dare to do so after the 1st of February 1833. The other Southern States refused to take part with South Carolina, preferring the constitutional course of applying to Congress again for a further reduction of the tariff.

On the 4th December, 1832, the Congress met, and the message of the President (A. Jackson)—at all times a subject of interest and curiosity—was this year expected with more impatience than usual, from the events which had lately taken place in South Carolina, and the menacing attitude of other southern sections of the Union. It was naturally imagined that the President would be compelled to take notice of such angry dissensions, combined with threats of resistance, and that he would detail the measures which Government had already taken, or intended to take, to allay discontent, or to ensure obedience.

The message, as will be seen by the following extract, did not disappoint these expectations. After alluding to the foreign relations of the Republic, the President frankly enters upon the question of the tariff, and expresses his disapprobation, both of the principle on which it is founded, and the excessive duties which it imposes:—

"I cannot too cordially congratulate the Congress and my fellow-citizens on the near approach of that memorable happy event—the extinction of the public debt of this great and free nation. Faithful to the wise and patriotic policy marked out by the legislation of the country for this object, the present administration has devoted to it all the means which a flourishing commerce has supplied, and a prudent economy preserved, for the public Treasury. Within the four years for

which the people have confided the executive power to my charge 58,000,000 dollars will have been applied to the payment of the public debt. That this has been accomplished without stinting the expenditures for all other proper objects, will be seen by reference to the liberal provision made, during the same period, for the support and increase of our means of maritime and military defence—for internal improvements of a national character—for the removal and preservation of the Indians—and, lastly, for the gallant veterans of the Revolution.

"The final removal of this great burden from our resources, affords the means of further provision for all the objects of general welfare and public defence which the constitution authorises, and presents the occasion for such further reduction in the revenue as may not be required for them. From the report of the Secretary of the Treasury, it will be seen that, after the present year, such a reduction may be made to a considerable extent, and the subject is earnestly recommended to the consideration of Congress, in the hope that the combined wisdom of the representatives of the people will devise such means of effecting the salutary object as may remove those burdens which shall be found to fall unequally upon any, and as may promote all the great interests of the community.

"Long and patient reflection has strengthened the opinions I have heretofore expressed to Congress on this subject, and I deem it my duty, on the present occasion, again to urge them upon the attention of the Legislature. The soundest maxims of public policy, and the principles upon which our Republican institutions are founded, recommend a proper adaptation of the revenue to the expenditure; and they also require that the expenditure shall be limited to what, by an economical administration, shall be consistent with the simplicity of the Government, and necessary to an efficient public service. In effecting this adjustment, it is due, in justice to the interests of the other States, and even to the preservation of the Union itself, that the protection afforded by existing laws to any branches of national industry should not exceed what

may be necessary to counteract the regulations of foreign nations, and to secure a supply of those articles of manufacture—essential to the national independence and safety in time of war. If, upon investigation, it shall be found, as it is believed it will be, that the legislative protection granted to any particular interest is greater than is indispensably requisite for those objects, I recommend that it be gradually diminished, and that, as far as may be consistent with these objects, the whole scheme of duties be reduced to the revenue standard as soon as a just regard to the faith of the Government and to the preservation of the large capital invested in establishments of domestic industry will permit.

"That the manufactures adequate to the supply of our domestic consumption would, in the abstract, be beneficial to our country, there is no reason to doubt; and to effect their establishment, there is, perhaps, no American citizen who would not for a while be willing to pay a higher price for them. But, for this purpose, it is presumed that a tariff of high duties, designed for perpetual protection, has entered into the minds of but few of our statesmen. The most they have anticipated is a temporary and generally incidental protection, which they maintain has the effect to reduce the price by domestic competition below that of the foreign article. Experience, however, our best guide on this as on other subjects, makes it doubtful whether the advantages of this system are not counterbalanced by many evils, and whether it does not tend to beget in the minds of a large portion of our countrymen a spirit of discontent and jealousy, dangerous to the stability of the Union.

"What, then, shall be done? Large interests have grown up under the implied pledge of our national legislation, which it would seem a violation of public faith suddenly to abandon. Nothing could justify it but the public safety—which is the supreme law; but those who have vested their capital in manufacturing establishments cannot expect that the people will continue permanently to pay high taxes for their benefit when the money is not required for any legitimate purpose in the administration of the government. Is it not enough that

the high duties have been paid as long as the money arising from them could be applied to the common benefit in the extinguishment of the public debt?

"Those who take an enlarged view of the condition of our country must be satisfied that the policy of protection must be ultimately limited to those articles of domestic manufacture which are indispensable to our safety in time of war. Within this scope, on a reasonable scale, it is recommended by every consideration of patriotism and duty, which will, doubtless, always secure to it a liberal and efficient support. But, beyond this object, we have already seen the operation of the system productive of discontent. In some sections of the Republic its influence is deprecated as tending to concentrate wealth into a few hands, and as creating those germs of dependence and vice which, in other countries, have characterized the existence of monopolies, and proved so destructive of liberty and the general good. A large portion of the people in one section of the country declares it not only inexpedient on these grounds, but as disturbing the equal relations of property by legislation, and, therefore, unconstitutional and unjust.

"Doubtless, these effects are in a great degree exaggerated, and may be ascribed to a mistaken view of the considerations which led to the adoption of the tariff system; but they are, nevertheless, important in enabling us to review the subject with a more thorough knowledge of all its bearings upon the great interests of the Republic, and with a determination to dispose of it so that none can with justice complain.

"It is my painful duty to state that, in one quarter of the United States, opposition to the revenue laws has risen to a height which threatens to thwart their execution—if not to endanger the integrity of the Union. Whatever obstructions may be thrown in the way of the judicial authorities of the general Government, it is hoped they will be able peaceably to overcome them by the prudence of their own officers and the patriotism of the people. But should this reasonable reliance on the moderation and good sense of all portions of our fellow-citizens be disappointed, it is believed that the

laws themselves are fully adequate to the suppression of such attempts as may be immediately made. Should the exigency arise rendering the execution of the existing laws impracticable from any cause whatever, prompt notice of it will be given to Congress, with the suggestion of such views and measures as may be deemed necessary to meet it."

The resistance of the people of South Carolina to the fiscal laws of the Union, threatened the Confederation with an immediate civil war, or with a political separation. To ward off such a catastrophe, the President issued a proclamation against the revolters of the refractory State, and, at the same time, ordered his ministers to introduce into the Legislature measures which might prevent the necessity of resorting to violence.

These measures were a tariff bill, sanctioned by Government, which was reported with all convenient speed in the House of Representatives, obviously designing, by the satisfactory reduction of duties before the 1st of February, to deprive the inhabitants of South Carolina of all pretext for putting into execution the great project of resistance which they had fixed for that date. On almost all manufactured articles the reductions were considerable.* The other measure was a bill introduced into the Senate, for more effectually

* On iron, in bars or bolts, not manufactured in whole or in part by rolling, a duty at and after the rate of 18 dollars the ton, until the 2d day of March, 1834, inclusive—and thereafter a duty at and after the rate of 15 dollars the ton.

On bar and bolt iron, made wholly or in part by rolling, a duty at and after the rate of 30 dollars the ton, until the 2d day of March, 1834, inclusive—and thereafter a duty of 24 dollars the ton, provided that all iron in slabs, blooms, or other form less finished than iron in bars or bolts, and more advanced than pig-iron, except castings, shall be rated as iron in bars and bolts, and pay duty accordingly. All scrap and old iron shall pay a duty of 12 dollars 50 cents. the ton. Nothing shall be deemed old iron that has not been in actual use, and fit only to be remanufactured; and all pieces of iron, except old, or more than six inches in length, or of sufficient length to be made into spikes and bolts, shall be rated as bar, bolt, rod, or hoop-iron, as the case may be, and pay duty accordingly. All manufactures of iron, partly finished, shall pay the same rates of duty as if entirely finished. All vessels of cast-iron, and all castings of iron, with handles, rings, hoops, or other addition of wrought-iron, shall pay the same rates of duty as if made entirely of cast-iron.

On iron, in pigs, a duty at and after the rate of 50 cents. for every 112 lbs. weight, until the 2d day of March, 1834, inclusive—and thereafter a duty at and after the

enforcing the duties of customs, so long as they should be exacted.

The State of South Carolina extended the term from the 1st February to the 3d March, to give an opportunity for the passing of some satisfactory measure by Congress.

The bill for the regulation of the tariff was disputed in the House for nearly two months—it was opposed by both parties, and could give satisfaction to neither. The permanent committee of the New York Convention drew up a series of resolutions against it; and the committee on agriculture, who had been instructed to inquire into the influence which the encouragement given to the manufacturing interests of the State, had upon the interests of agriculture, and upon the purchase and settlement of the unseated lands of the Commonwealth, also reported against the reduction of duties.* In the Senate likewise the Enforcing Bill met with great and violent opposition. The session was drawing to a close and nothing had been done. The termination not only of the session, but of the 22d Congress, was to take place on the 2d March; and though a new election, and a long interruption of legislative labours were to intervene, nothing had been effected to pacify the plantation states, or to quell the threatened insurrection in South Carolina. Under these circumstances, Mr. Clay, alarmed at the view of political affairs, brought forward a new tariff bill in the Senate, which met with the support of

rate of 40 cents. for every 112 lbs. weight. On cast-iron vessels, and all other castings of iron, a duty at and after the rate of 1 cent. the pound.

On steel a duty at and after the rate of 1 dollar 50 cents. for every 112 lbs. weight, until the 2d day of March, 1834, inclusive—and thereafter a duty of 1 dollar for every 112 lbs. weight.

On manufactures of iron and of steel, not herein enumerated, there shall be levied, collected, and paid, the several rates of duty provided by existing laws, until the 2d day of March, 1834, inclusive—and thereafter the lowest rate of duty which should have been payable on the same, either under the Act of the 27th of April, 1816, entitled "An Act to regulate the Duties on Imports and Tonnage;" or by virtue of the Acts of the 13th of July, 1832, entitled "An Act to alter and annul the several Acts imposing Duties on Imports."

* There is nothing of consequence in this report beyond what has been already introduced in the report of the Convention, from which it is evidently drawn up.

Mr. Calhoun, the senator from South Carolina, and of other senators from the southern section of the Union, being cordially received as the pledge of peace.

It was entitled a bill "To modify the Act of the 14th July, 1832, and all other acts imposing Duties on Imports." The first section fixes all duties at 20 per cent. *ad valorem*, after 1842.

"That from and after the 31st day of December, 1833, in all cases where duties are imposed on foreign imports, by the Act of July 14th, 1832, entitled 'An Act to alter and amend the several Acts imposing Duties on Imports,' or by any other act, shall exceed 20 per cent. on the value thereof, one-tenth part of such excess shall be deducted; from and after the 31st day of December, 1835, another tenth part thereof shall be deducted; from and after the 31st day of December, 1837, another tenth part shall be deducted; from and after the 31st day of December, 1839, another tenth part thereof shall be deducted; and from and after the 31st day of December, 1841, one-half of the residue of such excess shall be deducted; and from and after the 30th day of June, 1842, the other half thereof shall be deducted."

This bill, as well as the Coercion Bill, passed both Houses, and were approved by the President on the 2d March, 1833.

The statements of the votes on the two measures are important, as indications of the complete separation in commercial interest and political feeling between the different sections of the great American Union.* It will be seen that the new

* Votes in the United States Congress on the Tariff and Enforcing Bills.

TARIFF BILL.

States.	Ayes.	Noes.	Absent.	Total.
Maine	6	1	0	7
New Hampshire	4	1	1	6
Massachusetts	0	13	0	13
Rhode Island	0	2	0	2
Vermont	0	5	0	5
Connecticut	0	6	0	6
	10	28	1	39

tariff, which is to deprive manufacturing industry of all protection after the year 1842, is opposed by twenty-eight out of

States.	Ayes.	Noes.	Absent.	Total.
New York	11	19	4	34
New Jersey	0	6	0	6
Pennsylvania	4	21	1	26
Delaware	0	1	0	1
Maryland	9	0	0	9
	24	47	5	76
Virginia	20	1	0*	21
North Carolina	13	0	0	13
South Carolina	9	0	0	9
Georgia	6	0	1	7
Alabama	3	0	0	3
Mississippi	1	0	0	1
Louisiana	3	0	0	3
	55	1	1	57
Kentucky	12	0	0	12
Tennessee	9	0	0	9
Ohio	7	6	1	14
Indiana	2	1	0	3
Illinois	1	0	0	1
Missouri	0	1	0	1
	31	8	1	40
	120	84	8	212

ENFORCING BILL.

States.	Ayes.	Noes.	Absent.	Total.
Maine	7	0	0	7
New Hampshire	4	1	1	6
Massachusetts	13	0	0	13
Rhode Island	2	0	0	2
Vermont	5	0	0	5
Connecticut	5	0	1	6
	36	1	2	39
New York	27	3	4	34
New Jersey	0	3	3	6
Pennsylvania	24	1	1	26
Delaware	1	0	0	1
Maryland	8	0	1	9
	60	7	9	76

* Add Speaker (Stevenson), who did not vote, of course.

thirty-eight votes in the Northern States, and by forty-seven out of seventy-one in the Eastern, while, in the Southern, it is supported by fifty-five out of fifty-six, and in the Western by thirty-one out of thirty-nine. On the contrary, it will be observed, that the Enforcing Bill was supported by thirty-six out of thirty-seven votes in the Northern, and by sixty out of

States.	Ayes.	Noes.	Absent.	Total.
Virginia	8	13	0*	21
North Carolina	9	3	1	13
South Carolina	3	6	0	9
Georgia	1	6	0	7
Alabama	0	3	0	3
Mississippi	0	1	0	1
Louisiana	3	0	0	3
	24	32	1	57
Kentucky	7	4	1	12
Tennessee	7	2	0	9
Ohio	11	1	2	14
Indiana	3	0	0	3
Illinois	0	0	1	1
Missouri	1	0	0	1
	29	7	4	40
	149	47	16	212

On the passage of the Enforcing Bill in the Senate there was but one vote in the negative—that of Mr. Tyler, of Virginia: fifteen senators were absent—viz. Messrs. Seymour, of Vermont; Smith, of Maryland; Brown and Mangum, of North Carolina; Calhoun and Miller, of South Carolina; Troup, of Georgia; King and Moore, of Alabama; Black and Poindexter, of Mississippi; Bibb and Clay, of Kentucky; and Benton and Buckner, of Missouri. About eight of these gentlemen, had they been present, would have voted against the bill.

Bringing together the votes in the Senate and House of Representatives in one view, they afford the following results :—

	TARIFF BILL.		ENFORCING BILL.	
States.	Ayes.	Noes.	Ayes.	Noes.
New England	16	34	38	1
Middle States, including New York	32	52	69	7
Southern	67	1	28	33
Western	37	13	37	7
	152	100	172	48

* Add Speaker.

sixty-seven in the Eastern States, whilst its opposition in the Southern was reduced to thirty-two out of fifty-six, and in the Western to seven out of thirty-six.

The President still continued to make preparations for compelling the South Carolinans to obey his authority, but his instructions to the officer in command at Charlestown proved his moderation of temper, and his anxious wish for an amicable adjustment. And this object was attained; the passing of the Tariff Act gave great satisfaction; they considered it as an abandonment of the existing system, and an engagement that industry should henceforward be released from all fiscal regulations. The South Carolina Convention for organising resistance to the enforcement of the tariff, in consequence resigned its office, and by the following "ordinance" nullified its own nullification acts.

"Whereas, the Congress of the United States, by an Act recently passed, has made such a reduction and modification of the duties on foreign imports as amounts substantially to an absolute reduction of the duties to the revenue standard; and that no higher duties shall be laid than may be necessary to defray the economical expenditures of the government:

"It is, therefore, ordained and declared, that the ordinance, entitled 'An Ordinance to nullify certain Acts of the Congress of the United States, purporting to be Laws laying Duties on the Importation of Foreign Commodities,' and all acts passed in pursuance thereof, be henceforth deemed and held to have no force or effect, provided that the Act, entitled 'An Act further to alter and amend the Militia Laws of this State,' passed on the 20th day of December, 1832, shall remain in force until it shall be repealed or modified by the legislature."

In conclusion, we will take a brief review of the principal facts recorded in this portion of the history. There is no data by which we can ascertain the quantity of iron produced in the United States prior to 1810. At that time, according to the official returns, the quantity of bar-iron made in this country was 24,471 tons, then valued at 2,640,778 dollars, of which 10,969 tons were made in Pennsylvania. From that

time to 1830, the quantity had increased to 112,866 tons; in addition to which, 25,250 tons of castings were also made—the value of both amounted to 13,329,760 dollars: in making this quantity, 29,254 men were employed, and 146,273 subsisted, whose annual wages amounted to 8,776,420 dollars, and that in their support the farmer furnished food to the value of 4,000,490 dollars.

The average quantity of hammered iron imported into the United States from 1821 to 1830 was about 26,200 tons annually, and of rolled iron about 5600 tons—making together 31,800 tons, valued at 1,762,000 dollars. The whole quantity of hammered and rolled iron consumed in the United States in 1830 may be estimated at about 144,666 tons.

The value of the various foreign manufactures of iron consumed in this country, on an average, from 1821 to 1830, was about 4,000,000 dollars yearly—making the whole amount of foreign iron and its manufactures annually consumed in the United States—say 5,762,000 dollars.

If the whole quantity made in the United States in 1830 were computed in pig-iron it would amount to 191,536 tons—produced from 239 furnaces, averaging fifteen and a half tons each furnace per week—two-fifths of this quantity were made in Pennsylvania.

"The quantity made in all the States in 1837 may be fairly taken at 250,000 tons."* †

* Extract of a letter from Isaac Lea, Esq., to Nicholas Biddle, Esq., dated Philadelphia, 4th April, 1838, and printed in the "Colonization Herald," at Philadelphia, 25th April, 1838.

† The following is an extract from the Memorial of the Citizens of Lancaster City and County, in the State of Pennsylvania, presented to the Senate and House of Representatives of the United States, in Congress assembled, and embodied in the Report of a Select Committee to whom was referred "so much of the Executive communication as relates to the establishment of a National Foundry for Cannon, to be common to the service of the Army and Navy of the United States."

Read, January 12, 1839.

To the Honourable the Senate and House of Representatives of the United States.

"The memorial of the subscribers, citizens of the city of Lancaster, in the state of Pennsylvania, respectfully represents:

"That they have observed, with great satisfaction, the recommendation by the Secretary of War, in his last annual report, of the establishment of a national foundry for the manufacture of cannon for the use of the army and navy of the United States; and believing, that if carried into effect, it will essentially promote the public interests, they respectfully request its adoption by Congress.

"They beg leave also to suggest the advantages possessed by the city of Lancaster as a site for the proposed foundry. It is situated in the heart of a fertile, well-cultivated, and populous country: removed from all danger of attack by a foreign foe, yet sufficiently near the seaboard to afford ample facilities for speedy communication with it, at several points. Connected by an inland water-communication with the three principal ports of Philadelphia, New York, and Baltimore, and also with Philadelphia by rail-road, the means of transportation to these points, and to the navy yard at Norfolk, are ample.

"Lancaster county furnishes an inexhaustible quantity of iron ore, supplying eleven furnaces within its borders and in its immediate vicinity: the iron is pronounced by competent judges to be superior to any other known, in the qualities requisite for the manufacture of cannon. The county is well supplied with wood, and the city is connected by canals and rail-roads with the immense coal regions of Pennsylvania. All the materials wanted for conducting such an establishment can be obtained at Lancaster, with the greatest facility and at the least expense; and the abundant supply of water, and the remarkable healthiness of its location, are advantages not to be overlooked in the selection of a site for the contemplated foundry.

"At a more remote distance, but easy of access, by canals and rail-roads, it would be vastly greater at the site proposed for the erection of a National Foundry near the debouche of the Conestoga river, in Lancaster county, into the waters of the river Susquehanna, and the Susquehanna and tide-water canals, terminating at Havre-de-Grace, in Maryland.

"The probable average cost of coal would be from 3 drs. to 4 dol. per ton. Cost of pig-metal, say 30 drs. per ton. Water-power from 13 to 25 feet. Breadth of river, 280 feet. It is constant and believed to be abundant. Distance to tide-water about 35 miles. A great abundance of iron ore exists in the neighbourhood, within a mile; and within eight miles the best pig-metal is made for foundry purposes, which comes to the Philadelphia market.

"The county of Lancaster is one of the most fertile and best cultivated of any in the State of Pennsylvania. Provisions there are cheap and abundant.

"The quantity and quality of iron mines is believed to be inexhaustible, and of the best description for the purposes of a foundry. Iron ore abounds in the immediate vicinity. The pig-metal, made from the Conowingo mines, situate at a distance of about eight miles, is considered the best for foundry purposes, that comes to the Philadelphia market.

"The nearest coal-field, now extensively opened, is between 70 and 80 miles distant, and accessible by a short rail-road, and by canals. It is the lightest and easiest of ignition of any anthracite coal yet discovered. Veins of coal are now opening much nearer and within a few miles of the Conestoga river. With present facilities, coal could be delivered at a cost of from 3 to 4 drs. per ton.

"The number of furnaces, forges, and rolling-mills, within the distance of

about 50 miles from Lancaster, all now in active operation, is one hundred and two."

Furnaces, forges, and rolling-mills in Lancaster county, Pennsylvania:—

	No.	Total Make. Tons.	Average per Furnace. Tons.
Furnaces . . .	29	30,700	1058
Forges . . .	59	12,615	
Rolling-mills . .	14	not given.	
	102		

102 Total number of iron manufactories within a range of fifty miles.

The make of three forges not given—two furnaces building.

CHAPTER XII.

OTHER COUNTRIES IN EUROPE AND ASIA.

BELGIUM.—This country, formerly comprehended in the district of Gaul, needs not for our purpose the recapitulation of early and obscure accounts of what in our days we find carried out so efficiently and scientifically in the manufacturing of iron. With a view, therefore, to condensation, having already in our chapter on France touched upon remote periods, we now pass at once to notice the present era.

The whole of the iron produced in Belgium is consumed in home manufactures of cutlery, hardware, &c.—none of the raw material is exported. In the year 1822 there was placed at the disposal of the king an annual sum of 1,000,000 florins for the encouragement of industry by premiums, loans, and other means. We shall not notice any of the minor instances of the useful application of this fund, in the way of loans of capital, but shall mention the assistance afforded to Mr. Cockerill, an Englishman, on account of the more general effect which the encouragement given to him was intended to produce. The first object was to improve the method of smelting and manufacturing iron in the mining districts; for that purpose Mr. Cockerill had been invited by the king to settle in the neighbourhood of Liege. He received a very large sum, by way of loan, in order to assist him in the extension of his works; coupled with a condition that the iron-masters of Liege and Namur should have liberty to go there, to learn the true principles, and the latest improvements in the art. The unremitting industry of Mr. Cockerill formed a large establishment for machinery of every description, one

of the most perfect establishments in Europe.* Belgium is now celebrated for its iron manufactures. In 1822 there were 93 furnaces, 206 forges, 68 hammers, 19 foundries, and 17 rolling mills, producing of wrought iron about 500,000, and of cast-iron about 100,000 quintals.†

In 1835 the minister of commerce, in a report to the King, stated that in the provinces of Namur, Hainault, Liege, and Luxembourg there were 95 furnaces, 200 forges, and more than 20 rolling mills, amongst which are 7 on the English plan.

The rolling mills produce the following quantities per annum :—

Liege	2800	Tons.
Seraing	3000	,,
Acos	2000	,,
Ives	2800	,,
Fayt	3000	,,
Marchiennes	2100	,,
	15,700	Tons.

A report, addressed to the Chamber of Deputies in 1837, states :—

89 furnaces in work.
66 charcoal.
23 coke.

The coke furnaces produce from three to five times as much as the charcoal.

Total produce 1,350,000 quintals.

Isle of Elba.—Ancient Ilua is about nine miles long and three in breadth, and has been remarkable from early antiquity for its metallic productions, particularly ores of iron, often

* *Times* paper, 7 April, 1840.—Liquidation de John Cockerill à Liége. Sur la proposition de M. John Cockerill, et de l'avis de MM. les Commissaires au Sursis, le public est informé que l'Etablissement de Seraing, situé près de Liége, sera mis en Vente Publique le 30 Avril, 1840. Liége, le 1er Avril, 1840. Par délégation, le Secrétaire de la Commission, L. Tremp'ier.

Liege, March 10.—The sale of Mr. Cockerill's establishment, comprising two lots, the 1st, Seraing and its dependencies; 2d, the house at Liege and those of Spa and Tilleur, could not be effected to day, as had been announced, no buyers having appeared.—*Brussels* paper, March 12, 1841.

† About 220 lbs.

crystallized and mingled with native Prussian blue. The chief mine is that of Rio, worked like a quarry, in the eastern part of the isle; but as there is no water, it is smelted near Piombino. Ferber, 1772, himself a Swede, says that the iron ore of Elba is equal to that of Sweden. "It is not found in veins, but in a large hill or mass of solid ore, surrounded with granite mountains. They dig it not in expensive mines, but in quarries; but these people are greatly deficient in its smelting and preparation, which I have also observed in the iron magazine at Florence. The iron ores are exported from Elba to the Roman and Tuscan dominions."

Modena has iron foundries near the Apennines.

Switzerland.—The chief mines of Switzerland are those of iron, in the country of the Sargans.

Austrian Dominions.—In this improving empire, the iron of Styria supplies the finest steel; it is chiefly found at Eisenerst and Vonderberg. The former in the district of Ensthal, so called from the river Ens. These mines were discovered in 1712. Styria also affords coal at various places. On the east extends the Duchy of Carinthia, also yielding excellent iron; the mine Friesach, on the north, being particularly famous as well as those on the sources of the Lyser. The mountain of Erzeberg is a solid mass of iron ore; it annually yields 13,000 tons. The total produce of Styria in iron is said to be from 16,000 to 20,000 tons. There are 200 forges and thirty manufactories, where about 300,000 sickles and some scythes are annually made (1830). The iron mines of Styria have been worked more than a thousand years.

It is difficult to ascertain the extent of the iron produced in Styria; the greatest part is consumed in Austria itself, and only a small part exported in the shape of agricultural implements, and other manufactured articles, to different parts of Italy, the Levant, and Africa, within the Mediterranean. There is no export beyond the Straits of Gibraltar. Some

attempts made to trade to the Brazils and St. Domingo failed entirely, on account of the cost being much higher than that of English manufacture.

It is also difficult to state the extent of the iron produced in Carinthia. The Carinthian iron is principally converted into steel, of which the export is considerable, and now forms the chief supply of the South American mines, where this steel, on account of its hardness, is preferred to the Biscayan steel, which was formerly used. The export of steel may be stated at about 1,300 tons annually.

By Porter's Tables it appears, that the exports from Venice, during the three years ending 1831, were as follows :—

		1829.	1830.	1831.
Iron—Bars and Plates,	cwts.	1839	2960	1947
,, Beaten (Steel)	,,	904	1245	1118
,, Manufactures	,,	1526	2179	208

Saxony.—In the year 1837 there were 19 blast furnaces, 15 iron foundries, and 31 other manufactories. The produce of iron was 99,427 quintals. The iron mines of Dresden are very productive. Nor must coal and turf be forgotten as among the mineral productions of this remarkable district.

Carniola, or Kran, has a few iron works.

Moravia produces iron in great abundance.

Tyrol.—Nasereit on the Verner mountains, about thirty miles north-west of Inspruck, is rich in iron.

Hungary.—The iron mines in this country are almost inexhaustible. The best iron is drawn from a mountain called Kradek, near Esetnek; but as this metal is not subject to any duty or tithe, the annual produce of these mines is not ascertained. In the county of Goemer, including the district Kleinhout, there are 8 great furnaces and 87 small ones, and 49 forges, which furnish annually 94,200 quintals, worth 1,304,240 florins, yet this country is indebted to Austria,

for most of their tools as well as their vessels made of this metal.

BOHEMIA possesses both iron and coal.

PRUSSIA.—In this kingdom good government has been, and still is producing its invaluable consequences of general improvement. In the southern provinces there are considerable foundries of iron. Coal occurs in various parts of Silesia. In our introductory chapter we have adduced a remarkable fact from the notice of the manufactory of Devaranne; and besides the object for which it was there adduced, we may here specially instance it, as shewing also the importance of the manufacture in these improved minutiæ, and the genuine patriotism which originated their introduction. The cast-iron ornaments of Berlin foundry are extremely beautiful.

HANOVER possesses iron, coal, peat, and limestone, the last from the hill Kalkberg, near Luneberg.

WURTEMBURG.—Iron is found, but was chiefly brought from Mont Beliard. Coal is also found.

ANSPACH.—In this district the chief mines are iron.

NASSAU.—This duchy has mines of lead, silver, and iron, the ore of which is extremely rich, but the quantity wrought is not very considerable.

PORTUGAL.—There is neglect of the iron mines in this kingdom from deficiency of fuel, though coal is found in several places, and that of Buarcos supplies the royal foundry at Lisbon.

M. Theodore Virlet, in his General and Statistical Review of Metallurgy (Paris, 1837), gives the following statistical table of iron produced in Europe:—

	Quintals.
England (1827)	7,098,000
France (1834)	2,200,000
Russia (1834)	1,150,000
Austria (1829)	850,000
Sweden (1825)	850,000
Prussia	800,000
The Hartz Mountains	600,000
Holland and Belgium	600,000
Elba and Italy	280,000
Piedmont	200,000
Spain	180,000
Norway	150,000
Denmark	135,000
Bavaria	130,000
Saxony	80,000
Poland	75,000
Switzerland	30,000
Savoy	25,000

ASIA.

In Chapter IX. we have already spoken of the portion of Asia included in the dominions of Russia. It remains now to enter upon the remaining part of that most interesting quarter of the globe, where man was first blessed with existence. The sacred volume has vouchsafed to inform us in many things, for which we may vainly search the writings of profane heathen writers. We have already in our first chapter enlarged upon this part of the subject, in evidence that in Asia originated the knowledge of metals and the art of mining, and those arts were practised extensively by the early inhabitants, the Phenicians.

DAMASCUS was formerly celebrated for the manufacture of sabres of such superior excellence that they would bend to the hilt without breaking, while the edge was so keen as to divide the firmest coat of mail, and which are supposed to have been constructed by a process now lost, of alternate layers of iron and steel.

Tamerlane, when he took the city in 1400, is said to have carried into Persia their best artists in steel; but Brocquierere speaks of the inhabitants of Damascus, in 1432, as still excel-

ling in those manufactures. "The Damascus blades are the handsomest and best of all Syria, and their mode of burnishing them is by rubbing the blade up and down with a small piece of wood fixed in an iron, which thus cleans off all inequalities as a plane does to wood. They then temper and polish it. The polish is so highly finished as to resemble a mirror." He adds, "There are made at Damascus and the adjoining country, steel mirrors that magnify objects like burning glasses. I have seen some that reflected heat so strongly as to set fire to a plank 15 or 16 feet distant."

Arabia.—There are mines of iron in the district of Saade, in the North of Yemen, but the metal is brittle. There are also iron mines in Diarbekr and Siwas.*

China.—This immense empire contains much iron ore, yet they import some iron from Britain and Russia. Fossil coal is used generally by the people. Pekin is supplied with it from the high mountains in its vicinity, and the mines seem to be inexhaustible. Iron is sold at a moderate price, and is abundant. It was the policy of government to discourage the working of ores of copper, silver, gold, and iron.

Japan.—Iron seems in this country to be scarce; it is however found in the provinces of Mimasaka, Bitoju, and Bisen; but they are reluctant either to export or import it for sale. Of it they manufacture scimetars, arms, knives, and scissors, and various other implements. Pit-coal is found in the northern provinces.†

Sumatra.—There are excellent ores of steel and iron in this island.

Borneo contains iron.

The Manillas.—Luzon.—Iron is among the products of this island.

* Niebuhr, 135.

† Pinkerton, Mod. Geog.

SIAM.—The iron mines in this kingdom, called mines of steel by Turpin, would probably imply a pure iron ore easily convertible into steel, or rather perhaps a carbonated ore, which however was so little wrought, that wooden anchors were used. Near Luovo is a mountain of loadstone, and another in Junkceylon of inferior quality.

The BIRMAN EMPIRE contains abundance of iron ore.

CEYLON.—Iron is mentioned by Thunberg as among the minerals of this island.

PERSIA.—In this nation the people were much famed for their bows, which were the most esteemed of all in the East, and also for sabres finely damasked, in a manner which Chardin thought inimitable in Europe; for, not content with their own mines of steel or carbonated iron ore, they imported from India and wrought it in a particular manner. Their razors and other works in steel were also of good workmanship. In the northern provinces there are many mines of iron, but the metal is harsh and brittle. Mines of steel ore or carbonated iron are also wrought in the same region, and are so impregnated with sulphur, that filings, when thrown on the fire, flash like gunpowder.

The following recent interesting notice of the iron mines of Caradogh, near Tabreez, by Major James Robertson, late director of the Shah's ordnance works, was read before the Royal Society of Edinburgh.

"We have no historical record from which to ascertain the period at which the iron mines in the district of Caradogh were first wrought; but there is every reason to suppose that they were resorted to from the remotest antiquity. The district itself is very secluded, and is of a wild, forbidding aspect; it has, without almost any interval, formed part of the Median, and latterly of the Persian empire; and, under the rule of native princes, has all along been free from the revolutions which have so frequently convulsed Western Asia. The iron mines themselves also bear evident marks of anti-

quity. They form large quarry-like excavations, thickly surrounded by immense tumuli of iron sand and small pieces of ore, thrown out in the course of working. Upon a rough calculation, founded on the size of the excavated hollow which it exhibits, one only of the numerous iron mines, which abound in the district, was estimated by the writer of this notice to have now afforded above 4,000,000 cubic feet of iron ore. Taking the specific gravity of the ore at five, a cubic foot would weigh about 300 lbs., and, consequently, seven cubic feet would weigh about a ton; and 4,000,000 cubic feet, the total quantity excavated from that mine, would weigh 571,428 tons. Now, at the present day, 2000 horse loads is a full allowance for the yearly quantity carried away, and as each horse carries about two cwt., we have a total of 200 tons per annum as the exported produce at present. It may be reasonably assumed that this quantity has, upon an average, never been exceeded during the many ages in which the mines have been wrought. Indeed, this estimate certainly exceeds the actual average yearly produce; for although a considerable quantity of Russian iron is now imported, to supply the increasing wants of the inhabitants, it cannot be imagined that, in periods of their early history, the natives would require nearly so much iron as they now do. Upon that assumption, and without taking into account the other neighbouring mines, it would follow that 2857 years have passed since the soil was first removed from the surface of the mine alluded to. Were the other neighbouring mines taken into account, the antiquity of the whole would be proportionally increased. The writer has not by any means stated these as calculations, or as at all approximating to accuracy, but still he thinks that, from such data, fanciful as they may in some measure appear, an estimate may legitimately be formed on the very great antiquity of the Persian mines.

The native smiths are dispersed in small hamlets, situated in the woods which clothe the sides of the ravines, through which the mountain torrents flow into the river Arras (the ancient Araxes). The iron which is produced, although soft, is extremely tough. It is much superior to the Russian iron,

with which the greater part of Asia is now supplied, and is manufactured chiefly into horse-shoes and horse-shoe nails, for which there is a great demand in Tabreez and the surrounding districts, and among the Koords or Nomadic tribes who frequent the mountain pastures in summer. The trade in it is shared between the Mahomedans and the native Armenians; and although by no means extensive or deserving the name of the "Persian iron trade," it gives employment to a considerable part of the population in quarrying the ore, burning the charcoal, and transporting these articles to the forge.

"There are numerous mines in Caradogh, affording iron ore of the most valuable description, and of various kinds; but those held in the highest estimation are the Jewant, Koordkandy, and Marzooly ores.

"The Jewant Mine is situated in an immense vein of red iron ore. This ore, on its fracture, often exhibits streaks of prismatic colours, as if at one time it had been subjected to the action of heat; quantities of iron sand are dispersed in the interstices of the vein.

"The Koordkandy Mine, situated on the summit of a very steep mountain, produces rich magnetic iron ore, from a vein of great dimensions. The Marzooly Mine also affords excellent magnetic iron ore in great abundance. The vein in which the last is situated runs across the several hills, and is in most parts 100 feet in width.

"In working these mines, the richest pieces only of the ore are carried away; the remainder is thrown aside. They are worked very irregularly, and without concert, as there is no restriction imposed as to the mode of mining by the government. A few individuals sink a shaft through the rubbish, and excavate as much as they require; another party soon after arrive, and fill the first hollow up in the course of sinking another shaft; and in this way the rubbish is repeatedly turned over, and gradually subsides, and is consolidated into a mass as the ore is removed from beneath—thus forming a serious obstacle to any one who might attempt to work the vein in a more regular manner. The ore is carried to the

villages only during the summer, as the depth of the snow in winter renders the mountain paths impassable. It is there retailed to the smiths, who purchase a horse load of two cwt. for about 1s. sterling, or 10s. per ton.

"The ores above described, when smelted singly, produce that kind of iron which, by English workmen is called red-short, and by the Persians, salt-iron. The smiths, however, by means of a mixture, produce iron of an excellent quality, which they term sweet-iron. The most common mixture is two parts Jewant ore to one of Koordkandy, and two parts of Koordkandy to one of Marzooly.

"Materials for smelting the ore are found in an extensive natural forest which occupies the natural parts of the district of Caradogh. This forest covers the flat bottoms between the mountains, and spreads to a considerable height up their sheltered sides, dwindling into dwarf trees and bushes in the elevated and more exposed situations. It consists chiefly of coppice oak, which springs from the roots of trees cut and recut during a long succession of years. This jungle is partitioned among the villages situated on its confines, the inhabitants of which earn a livelihood by supplying the city of Tabreez and adjoining towns with fuel."

East Indies.—In the year 1833, an association was formed at Madras, with a view of establishing charcoal iron works, upon the European plan. By a statement * circulated by the association, it appears that the magnetic oxide of iron, which produces the steel-iron of India, is confined to that part of the peninsula south of the parallel of Madras. The ore mixed with quartz, "*forms mountain masses*," and is removed simply by quarrying with a crow-bar. "The ore is separated from the quartz by pounding and winnowing, and in this state, when ready for the furnace, it contains 72 per cent. of iron, and 28 of oxygen; and is absolutely free from any trace of sulphur, arsenic, or phosphorus." "This ore upon a large

* Statement of the origin, present state, and future prospects of the Indian Iron and Steel Company, with a view of extending its operations, and enlarging its capital. June 1, 1839.

average has been found to yield 68 per cent. of metal in the blast furnace." The extent of land for the supply of fuel in the neighbourhood of those situations which may be selected for the erection of iron works, "amounts to several millions of acres."

The works are situated at Porto Novo, a town on the sea-coast, about 120 miles south of Madras; they consist of four blast furnaces, a forge, and also a foundry; the make at present is confined to 50 tons of pig-iron per week, the engine not being of sufficient power to blow more than one furnace making that quantity.

This iron is sent to England and converted into steel of a superior description; it has also been tried for all purposes in which iron of the best quality is used, with satisfactory results. In the following years were forwarded,

	Bars.				Pigs.				Unwrought Steel.			
	T.	C.	qr.	lb.	T.	C.	qr.	lb.	T.	C.	qr.	lb.
1835	0	6	0	0	34	5	3	0	3	4	3	1
1836	13	14	3	19	59	3	2	27	8	14	0	17
1837	273	5	1	1	57	13	0	25	0	8	3	17
1838	489	4	0	8	376	1	0	14				
1839	....				2,232							

In the Himalayas, near Kusshain, a large village of Naawur, there are iron mines of micaceous iron ore; they are worked by running a horizontal shaft three feet and a half diam., into the side of the mountain. The ore is brought out in skins; it is pounded and washed, and then smelted; when reduced into small pigs, it is again put into the fire and hammered till malleable, all which is done on the spot. The furnaces are nothing but large clay crucibles, three feet high. When the contents are fused sufficiently, the impurities are run off into the ash-pit, leaving the iron in the crucible. (Major Sir W. Lloyd's Narrative, vol. i. p. 214.)

In Chapter I. we have already spoken of the mode of smelting iron ore in the Himalayas.

Lahore.—Runjeet Sing, at his iron works in his capital, Lahore, was quite indefatigable in promoting their successful operations, and he produced there, cannon and fire arms,

sabres and knives, of very superior quality, and to a considerable extent.

SOUTH AMERICA.

Mexico.—Iron, though little used by the ancient Mexicans, is more abundant than is generally believed, and particularly in the "*Provincias internas*," but is wrought with any degree of spirit only when a maritime war has interrupted the importation of iron or steel from Europe.

The enormous mass of malleable iron with nikel, near San Gregorio, is a natural curiosity, so exceedingly hard as to resist the chisel.

In the town of Leon, cutlery is manufactured which is much esteemed; it is the Sheffield of Mexico.

Chili.—Iron is so abundant that there are few rivers in Chili which do not deposit a sandy ore of that metal. Formerly, by special regulation, iron could not be wrought in the Spanish Colonies, but was a monopoly of the parent country. Many provinces of Chili have the compact black ore, the granular grey, and the solid cubical blue ore. Araucana contains also excellent mines of iron, supposed to be not inferior to that of Spain.

Brazil.—In the Serro de Frio, or the Cold Mountains, there are mines of iron very rich.

AFRICA.

The first chapter is supplied with some notices by Mungo Park.

Guinea.—On the western coast, the Foulahs of Guinea, are iron mines which are worked by women.

Morocco.—In the ridge of the Atlas, there are mines of iron, but they are neglected by the unskilful Moors.

CHAPTER XIII.

FROM THE YEAR 1830.

ARRIVING now at the final chapter, the arrangement, as laid down in the concluding paragraph of the Introduction, will be carried out. The history of the home manufacture from 1830 up to the present period, with remarks upon its state and prospects, and the surprising extent of improvements in the mode of operations, will occupy attention.

The rapidity with which skill, under the tuition of science, is advancing production, is not less striking than the novel and valuable application of iron to innumerable purposes unheard of anterior to the enormous supply now always attainable in the British market.

The great and increasing importance of the iron trade to this country, caused theory and practice to be brought into play to discover the best means of improving both the quantity and the quality of the iron, and the blast furnace underwent almost every variety of form, with the exception of those which have been found most beneficial in the present day. The old charcoal furnaces, from 12 to 18 feet high, or where a good water power existed, even 28 feet, gave place to coke furnaces of 40, 50, 60, and even in one instance 70 feet, of which height a furnace was erected in South Wales,* but, after in vain attempting to work it, they were obliged to reduce it, which they did to the extent of 30 feet by cutting a hole in the side, narrowing the mouth, and throwing in the materials at 40 feet instead of 70. The width of the boshes also varied from 10 to 15 feet, and an experiment was tried at Muirkirk, in Scotland, where they reduced the width of

* Rees' Cyclopædia.

the boshes from 10 feet to 8; the height of the furnace being 40 feet: but it was soon found that with the same volume of blast, which was formerly applied to the ten-feet furnace, very inferior effects were now produced. The combustion, apparently, was carried to too great an extent, and the materials, owing to this circumstance, entered into fusion before the iron had imbibed a sufficient dose of the coally principle from the fuel. Another great evil which resulted from this diminution of diameter, was a friction, or retardation of the descent of the materials upon the lining of the furnace. This evil was increased, and the materials made more buoyant, by the usual volume of air elevating itself in a cone not much more than half its former area. The consequences were, that the whole mixture of coke, ironstone, and limestone, would frequently hang for an hour together, or until the blast had cleared the hearth and boshes of materials, a slip would then ensue, and bring with it a large proportion of newly-introduced matter. The introduction of this into the fusing point, before being properly heated, and long before any affinity had been established betwixt the particles of metal and the carbon of the furnace, invariably changed the quality of the metal, and caused frequent and sudden alterations from grey to white iron.* But the general average height and width of the furnaces, about thirty years back, may be taken at 40 feet from the upper surface to the hearth bottom, 11 feet across the boshes, and 3½ feet for the diameter of the tunnel head, or furnace mouth. Till that time it had been the custom to blow the furnace with one tuyere; they now, however, at some works began to blow with two, and the beneficial effects being soon experienced, they became very generally introduced. No material alteration took place for some years, when accident in some degree discovered what now constitutes one of our greatest improvements. One of the Blendare Furnaces,† near Pontypool, built as usual, with a narrow top, carrying but little burden, and making neither quantity nor quality, by some chance gave way in the top, so

* Rees' Cyclopædia. † Mushet's Papers on Iron and Steel.

far as to widen the filling place to 9 or 10 feet. This accident was immediately followed by a cooler top, a better quality of iron, and a greater weekly quantity; and this accidental alteration furnished a model for the construction of other furnaces at the same works. Changes of this kind are not brought about rapidly, by reasoning or knowledge of principle, but by a series of slow observations and chance circumstances. The subject is, however, now better understood, and within the last five or six years the mouth or filling place of the furnace has been very generally enlarged; and instead of 3, 3½, or 4 feet, are now from 8 to 11 feet, and in some few instances larger.

One of the most striking varieties in the modern form of the furnace, and from which the greatest quantities of iron have been run, is the cylindrical form. Furnaces of this description are erected in many places, and amongst others at the Govan Works in Scotland, of which the following is an account of a fortnight's work :—

No. 1 Furnace—15 feet 8 inches in diameter, 45 feet high, cylindrical, from the boshes to within a few feet of the charging plate, where it is rapidly brought in to a convenient diameter for the tunnel head. Blown in 21st November, 1840.

Two weeks, ending December 12th, produced—

1st week 140 tons 1 cwt.	No. 1.	1st week
2d do. 145 „ 6 „	iron.	stopped 12 hours.

Blown with hot air, and 5 tuyeres, pillar of blast—3 lbs. per square inch, at tuyere pipes.

No. 2 Furnace—15 feet diameter, cylindrical, 45 feet high.

1st week 128 tons 15 cwt.	stopped 12 hours,
2d do. 150 „ 11 „	No. 1 iron.

No. 3 Furnace—Out of blast, being enlarged.

No. 4 Furnace—11 feet diameter, 45 feet high, and cylindrical :—

1st week 75 tons	stopped 12 hours,
2d do 77 „ 13 cwt.	No. 4 iron.

No. 5 Furnace—15 feet diameter, 45 feet high, and cylindrical :—

1st week	95 tons	No. 4 iron
2d do	116 ,, 13 cwt.	stopped 12 hours.

These furnaces were all blown with heated air, and have, within these few years, been erected by the proprietor, Mr. William Dixon, who made a series of experiments at the Calder Iron Works, the results of which satisfied him of the superiority of the cylindrical form, which he has here adopted. And the make is a good proof of the advantage of this form of furnace; but from 90 to 100 tons per week from a furnace is now by no means unusual; in fact throughout most of the works of South Wales the average make is seldom below 80 tons per week, but more generally as above stated.

But the boldest and most successful alteration in the form of the blast furnace was made by Mr. John Gibbons, of Corbyn's Hall. The account of his furnace was published by himself in a small pamphlet, and circulated amongst his friends. Mr. Gibbons' furnace is considered the best in Staffordshire, for the duration of the hearth and boshes, working to good yields, making good iron, and greatest quantity. The duration of the hearth and boshes appears to arise from the fact of the hearth being put in wider than they generally are, and consequently giving more room for the blast to act. The boshes commence a little above the tuyeres, and have nearly the same inclination as the curve of the furnace; the boshes, in fact, running 30 feet high; at which height is the widest part of the furnace, it being there 14 feet. Mr. Gibbons, an eminent ironmaster, a gentleman having ample opportunities of watching the blast furnace in its operations, observes, that he acquired the habit of observing with much attentive interest the changes effected by fire in its inner form; his attention was first more particularly directed to the very rapid destruction that takes place in the hearth and boshes during the early period of the furnace being worked: "at the end of six months it may, I believe, be safely stated as a general fact, that both of them have been carried away to the extent of at least a third of their substance. From this time, or about this time, for exact accuracy cannot be obtained on such a subject, the destruction

becomes gradual, and proceeds more or less slowly, till the boshes, either in some part of their circle, or the whole of it, are obliterated; and this may be called the natural death of the furnace—it will carry on its operations no longer." "The hearth may be replaced or repaired from without for an indefinite period, but the boshes are beyond our reach, and when they are gone the case is hopeless—the furnace must be blown out." Mr. Gibbons' observations extend in the second place to the upper part of the furnace. He states, that it appeared to him, if he at once *made* the room which the furnace *makes* for itself by a rougher operation, "I might probably preserve thereby a considerable portion of my hearth and boshes. I put in my hearth stones as wide asunder as the pillars of the stack would allow; I cut them upwards from the tuyeres to their junction with the boshes in a diagonal line, so as to bring them into the same, or nearly the same angle with the boshes, and I certainly found that my purpose was thus far answered.* The furnace lasted longer, the hearth did not call for repairs so soon; and there was this additional advantage, I arrived at my full burden and average make for months before the accustomed period." The second alteration Mr. Gibbons considers of even more importance:—From the appearance of the lining bricks, it was evident that in the old form of furnace, the heat in the upper part had little intensity, the fire-bricks were barely glazed. With the view, therefore, of accumulating heat in this hitherto useless part, instead of building the interior of his furnace in a straight diagonal, or nearly so, from the top of the boshes to the filling hole, or tunnel head, "I *scooped* it outwards, so far as I could do so with safety to its structure; this gave me much room upward, the effect was unequivocal, particularly in my yield of coal." He next increased the diameter of the tunnel

* Till this time the hearth stones were put in, forming a square of $2\frac{1}{4}$ to $2\frac{1}{2}$ feet at the bottom, and running up about 7 or 8 feet; and even to the present day there is a prejudice that the fire had better form its own hearth, but Mr. Gibbons very justly observes, "If the stones *melted* it would be true to the full extent, but they do not *melt*, they *shatter*, and detach themselves in fragments of irregular shape and size, according to their natural clefts or fissures.—If he were to build a new stack, he would place the pillars wide enough asunder to admit a five-feet hearth."

head, of which Mr. Gibbons considers that eight feet will be found the proper maximum, and in which case there must be, at least, four filling holes.

"Instead of beginning to contract the interior from the usual termination of the boshes (about twelve or fourteen feet from the bottom of the hearth) I have kept widening it upwards to the height of thirty feet (more than one-half of its total height) so that my boshes being twelve feet across, the widest part of my furnace, which becomes virtually the crown of my boshes, is full fourteen feet."

By which he attained the great object of removing the boshes from the action of the fire, by giving to their plane a steeper slope, and *much* greater elevation.

Mr. Gibbons states his last six months' make as averaging 100 tons per week. His best three months' work 107 tons per week; and his best week's work 115 tons, which shews an extraordinary regularity in the working of his furnace: this is the great point to be desired, especially where good and uniform quality is required. Mr. Gibbons' make "was always good grey forge-pigs."

Mr. Gibbons presses on the attention two circumstances which operate against his make; the first is the use of cinder, the second is an insufficient supply of blast, its density being only 1 lb. 13 oz. per inch, and its volume not adequate to the necessities of a common sized furnace.* The largest blast furnaces in South Wales are those of the Plymouth iron works†

* A Furnace on the Common Plan,

A Furnace on the Common Plan,		No. 4. Corbyn's Hall Furnace.	
45 feet high	would contain 2660 cubic feet.	50 feet high	contains 4850 cub. ft.
12 ,, boshes		Diameter as in the text	
4 ,, filling hole		8 feet filling hole	
3 ,, hearth		4 ,, hearth	
divided into two parts.			
The upper half 22½ feet	1060 ,,	The upper half 25 feet	2950 ,,
The lower do.	1600 ,,	The lower do.	1900 ,,

Mr. Gibbons says, he believes that there are not many furnaces in Staffordshire, which exceed the dimensions given of the furnace on the common plan; but he knows that some of those which work the best are only 11½ feet across the boshes.

† At the Plymouth Iron Works there are seven furnaces, all in blast, and all blown with cold air, making 700 tons of cast iron per week on an average.—"On the State and Prospects of the Iron Trade in Scotland and South Wales in May 1839, by J. Johnson. Liverpool."

at Duffryn, near Merthyr, 18 feet diameter in the boshes, and 9 or 10 feet at the filling place, the height 40 feet: so that their capacity is equal to at least 7000 cubic feet, and when at work each of them must contain at least 150 tons of ignited materials for iron smelting. There are three of these enormous furnaces into which are discharged per minute at least 20,000 cubic feet of atmospheric air, under a pressure of 1½ lbs. to the square inch.* This is below the general pressure in South Wales, which may be taken at 2½ lbs. on the inch; these furnaces, however, thus blown, frequently make 120 tons each weekly.

We cannot but be struck with this extraordinary increase in the make of a furnace, to which various causes have conduced—larger and better formed furnaces, improved blast, and also superior knowledge in the preparation of the materials, application of the blast, and working of the furnaces. It has been observed, that some of the furnaces which make the best work as to quality and yield, in Staffordshire, do not exceed 11 ft. 6 in. or 12 feet in the boshes. Where quality is an essential, a furnace of this size is more to be depended on than the very large ones. All furnaces require unremitting attention on the part of the manager; and even with this attention, aided by superior knowledge, the furnace will, owing to the great difficulty there is with some materials, occasionally get out of order, in which case a change is sooner brought through in a small furnace, than a large one—it is more manageable.

We must briefly refer to another and important process in the making of iron,† and which has mainly contributed to place our manufactured iron in its present high position. We speak of the puddling, an improvement for which we are indebted, as already shewn in the sixth chapter, to Mr. Cort.

* Mushet's papers on Iron and Steel.

† It has not been the object of this publication to enter into the particulars of the manufacture, beyond what was necessary to introduce any alteration and improvement; but, for those who are desirous of knowing the detail of the manufacture, we cannot do better than recommend for their perusal No. 106 of the Library of Useful Knowledge, "Manufacture of Iron," where they can learn every necessary particular.

This process, although so beneficial in itself, was nevertheless attended with a waste of about 20 cwt. of pigs to a ton of bars, or in other words, it took two tons of pigs to make one ton of bars;* and for some years afterwards it required 35 to 30 cwt., even when the process became much better known: at the present time the waste does not generally exceed from 6 to 7 cwt. of pigs to a ton of bars, including the waste in the refinery.

The principal improvement in the puddling is the substitution of iron for sand bottoms in the furnaces. At the time when the sand-bottoms were used, the puddlers seldom charged more than 2½ cwt. of metal, and could not work more than four heats in the twelve hours: the principal cause of delay arose from the puddler having to make a fresh bottom each time before he charged. Neither could they puddle pig-iron alone, in consequence of its boiling and getting mixed with the sand, the waste also was considerably more in this process than in any other mode of working.

They then tried another plan with a large metal basin to work pig; but they did not succeed, the pig melted so raw and liquid, it fastened to the edge of the basin and could not be got off by the puddler. Iron bottoms were then substituted, and are now very generally used.

In some works they have within a few years puddled all pig by a process called boiling, originating in the impression that the waste in the refinery might in a great measure be saved.

In Puddling Refined Metal.—The metal is first put in the furnace and melted; when melted, a small quantity of hammer slag is added to ferment it, and discharge the impurities of the iron; it is then worked by the puddler till it is in a sufficient state to be dried; the damper is put down, and the iron dried, after which the damper is raised up and fresh coals put on, and the iron is puddled till it is ready to ball and be taken to the hammer.

* Mr. Cort made 29 tons 3 cwt. 16 lbs. of bar-iron from 60 tons of government ballast.—Mushet's papers on Iron and Steel, p. 32.

Time melting	25 minutes.
From melting till dry	15 „
From being dried till shingled .	30 „
	70 „

Time lost in cleaning grate, charging furnace, &c. about 90 minutes in the course of 12 hours. 8 heats of 3¾ cwt. may be worked in the 12 hours.

In Boiling Pig-iron.—Before the charge is put in the furnace, a sufficient quantity of hammer-slag is put in, and then the pig-iron. Fresh coal is put on to melt the pig and hammer-slag. When it begins to melt, the puddler commences working it, and the more he works it the more it boils and the purer it is. If the iron is of good quality, it will boil for thirty or thirty-five minutes from the time it is melted. When done boiling, the cinder, which has been floating on the top of the iron, drops through it on to the plate, leaving the iron to be worked up, till by working it becomes malleable, and fit for balling. After the iron is taken to the hammer, the cinder is drawn from the furnace, and fresh hammer-slag used for the next heat.

Time melting	25 minutes.
Time boiling	35 „
Worked into a malleable state	55 „
	115

From the time of drawing a heat it is ten or fifteen minutes before the puddler is again able to charge. Six heats of 3¾ cwt. may be worked in the twelve hours.

There is also a difference in wages.

Say for puddling refined metal 8*s.* per ton.
„ boiling pig .... 10*s.* „

The yield also is in favour of the refined metal, no only in the puddling, but likewise in the after process of heating and rolling.

Boiling pig-iron, although not so advantageous to the ironmaster, is nevertheless generally done where they have not the convenience of refineries: it was adopted with the

idea of its being a cheaper mode of working, in saving coals, labour, and yield; but this is met by the extra quantity of coals used in the puddling, bearing on a smaller make, besides which the wages are higher, and there is a greater waste in the more expensive process. Also, a greater expence is incurred in keeping the furnace in order, as the pig-iron works hotter than the refined metal, and injures the bottom as well as the walls of the furnace.

In South Wales the boiling process has been very generally done away with, as it is not found to suit the general nature of the iron. The Staffordshire and Shropshire iron is, however, well suited for boiling, being of a strong-bodied nature, and there this method of working is still used to some extent, but more frequently where they have not refineries. Where, however, the iron is of a red short nature, a small quantity of grey pig is very beneficial, and materially assists the quality as well as the appearance of the iron.

With the view of saving the time, which is lost in heating the iron to the state in which it becomes fit for the puddler to commence his operations, there have been various contrivances for heating the fresh charge of metal, whilst the preceding heat is in progress. One plan is, to make the flue rather wider, so as to form a sort of recess for the reception of the fresh charge, which is placed there by the puddler's assistant through a small door for the purpose; and when his heat is finished, is drawn forward, and is ready for him to go on with, without any delay. The simplest method, however, is to make the body of the furnace longer than according to the old plan, and to have a second door, between where the puddler works and the stack. This affords sufficient convenience and room for the succeeding charge of metal.

With these furnaces nine heats can readily be worked by one man in twelve hours; and if, as is sometimes the case, the furnace is provided with three sets of men, instead of two, ten or even twelve heats may be finished in the twelve hours.

Economy of coal is the object of the iron master in this mode of working; and as the quantity used is nearly the

same, whether the furnace be constructed on the old or new plan, there is a considerable saving. The men, however, generally prefer the usual mode of working, and make about seven heats in the twelve hours, a quantity which they seldom exceed. The weekly average of a puddling furnace being from $12\frac{1}{2}$ to 13 tons.

The iron trade in Great Britain continued to make the most rapid progress; and as we shall see by the returns, the quantity of pig-iron during the nine years, subsequent to our last statement in 1830, doubled itself. The following we believe to be as correct an account of the quantity produced in 1839 as can be arrived at, considering that part of it is necessarily estimated:—

1839.	Furnaces, number in Blast.	Make per Annum.	
South Wales and Forest of Dean	125	532,480	Tons.
Staffordshire, South	108	338,730	,,
Ditto North	10	28,600	,,
Shropshire	24	86,060	,,
Yorkshire (1840)	31	89,960	,,
Derbyshire (1840)	13	37,440	,,
North Wales	12	28,080	,,
Newcastle-on-Tyne	5	11,440	,,
Scotland	50	195,000	,,
	378	1,347,790*	

* Mr. Mushet, in his elaborate "Papers on Iron and Steel," p. 421, states the make of 1839 as follows:—

	Furnaces in Blast.	Tons.
South Wales	122	453,880
Forest of Dean	5	18,200
Shropshire	29	80,940
Staffordshire, South	106	346,213
Ditto North	7	18,200
North Wales	13	33,800
Derbyshire	14	34,372
Yorkshire	22	52,416
Newcastle-on-Tyne	5	13,000
Scotland	54	196,960
	377	1,247,981
Lancashire Charcoal		800
Total of Pig Iron, Tons		1,248,781

eing an increase of 669,373 tons per annum on the returns f 1830.

The gradual increase of the two great districts of South Vales is shown by the following Tables of manufactured and ig-iron, conveyed on the Glamorganshire and Monmouthshire anals, from 1831 to 1840 inclusive.

IRON CARRIED ON THE GLAMORGANSHIRE CANAL IN THE FOLLOWING YEARS:—

Names of Proprietors and Works.	1831	1832	1833	1834	1835	1836	1837	1838	1839	1840
Guest and Co., Dowlais	22075	29395	35072	33477	39145	39286	38914	39361	40495	45218
Crawshay & Co., Cyfartha and Hirwain	15465	24668	37380	34952	35090	34654	33580	36986	37009	35507
Thompson and Co., Penydarran	11819	10582	12150	12752	12834	12537	12834	12707	15540	16130
R. & A. Hill, Plymouth	10498	9200	12093	12073	12631	13573	15353	16143	15762	12922
Aberdare Co.	6903	5997	6964	8497	9261	9981	9830	12247	11307	10327
Blakemore & Co.	2947	3042	3519	3194	4020	3957	3594	3474	3304	3175
Brown, Lennox, & Co.	626	757	890	1163	1854	2437	2756	3394	4037	2476
Gadly's Iron Co.			214	731	1828	1816	1756	1127	1081	1345
Taff Vale Iron Co.			3461	3739	3068	4723	6171	5198	4246	4902
Bute Co., Rhymney		36	572	434	127	124	22			
Tons	70333	83677	112315	111012	119858	123088	124810	130637	132781	132002

IRON CARRIED ON THE MONMOUTHSHIRE CANAL AND TRAM ROADS IN THE FOLLOWING YEARS:—

Names of Proprietors and Works.	1831.	1832.	1833.	1834.	1835.	1836.	1837.	1838.	1839.	1840.
J. and C. Bailey, Nanty Glo	17866	21333	21007	22594	24957	25384	23981	25263	24945	26662
Kendall and Co., Beaufort	5150	6052	2257							
Harfords and Co., Ebbw Vale and Sirhowy	18778	19740	19226	20228	25392	23120	22475	23579	25342	24199
Kenricks and Co., Varteg	11519	11171	10627	14762	14831	11209	7753			
British Iron Company, Abersychan	8022	7751	7295	8430	9724	12278	10261	11857	12481	12290
Hills and Wheeley, Blaenavon	9706	8986	8285	8406	9023	7606	5058			
Hills and Wheeley, Garnddyris	4133	1833	3600	2214	4286	4257	4159			
Frere and Co., Clydach	6231									
Sl. Homfray, Tredegar	13340	13304	12323	12858	13909	12133	12641	15526	14861	15288
Coalbrook Vale, Company	2189	2396	2429	2898	3211	3754	3325	4000	5204	7824
Russell and Co., Blaina	2921	7960	4880	6324	9233	8911	6675	7482	1140	
Hunt Bros, Pentwyn	4850	4038	4406	4057	6527	8207	6895	1848		
Bute Company, Rhymney	7548	7180	5611	3662	4198	2346				
C. H. Leigh, Pontypool	2710	2680	4064	4077	5253	3341	5337	9067	8002	9584
Daniels and Co., Abercarne	1023	889		279	1158	989	828	931	1060	
Pontymister Company	1060	1351	239	227	1039	1179	1101	2258	2413	
W. Russell, Machin	846	520		363	1257	796	737	847	961	
J. Brown, Tydee				15	51	100	235	39	62	9
R. Walker, Cwm Tylery		64		66	524	520	107	159	217	
J. Kennedy, Lanhiddel				25	150	108	365	362	174	
J. Jenkins and Company	841	276								
Sundry Persons	432	141	168							10
J. and C. Bailey, Beaufort			5255	9808	12976	14567	11145	10903	10505	10049
Varteg Iron Company							2669	9857	12820	12669
Blaenavon Company, Blaenavon							2092	8074	5718	7347
Blaenavon Company, Garnddyris							1456	5688	6708	6955
Clydach Iron Company		6542	7252	6261	7618	7640	7081	9283	9606	10038
Pentwyn Iron Company								2614		
Golynos Iron Company							1027	2509		
Pentwyn and Golynos Company								2982	12533	17783
Rhymney Iron Company						2963	6797	13547	14881	18581
Cwm Celyn and Blaina Company									4663	8937
Victoria Iron Company							77	692	2050	6436
Tons	119165	124207	118924	127554	155317	151408	144277	169367	176346	194661

DESCRIPTION OF IRON CARRIED ON THE MONMOUTHSHIRE CANAL AND TRAM ROAD IN THE FOLLOWING YEARS:—

Years.	Pigs.	Castings.	Metal.	Bars, Rails, and other Manufac. Iron.	Total Tons.
1831	30508	2137	9155	77365	119165
1832	36753	1214	4314	81926	124207
1833	34077	1719	3800	79328	118924
1834	43238	619	2801	80896	127554
1835	50799	5748	4286	94484	155317
1836	51097	5327	3790	91194	151408
1837	42844	5947	3209	92277	144277
1838	42139	5459	5047	116722	169367
1839	36259	4592	10906	124589	176346
1840	34584	4085	8081	147911	194661

The most extraordinary increase, however, is in the Scotch furnaces, and this leads us, in the first place, to speak of a very important discovery, as connected with the manufacture of iron, one which has already had a great effect, and will eventually exercise the greatest influence on the trade — I mean the substitution of *hot* for *cold air* in blowing the furnaces. It was long thought that the disadvantage experienced in the summer months, in the working of the furnaces, was to be attributed to the heat of the weather, and it was therefore supposed that a cold blast was most favorable to the smelting of the iron. The results obtained by the invention for the heating of the blast artificially before it passed into the furnaces, have proved how mistaken this notion was.

In 1829, Mr. Nielson, of Glasgow, manager of the gas works in that city, took out a patent for the application of hot blast in the manufacture of cast iron. ei

Some experiments made by Mr. Neilson, led him to imagine that advantage would be gained by heating the air previously to passing it into the furnace; he communicated his ideas to Mr. Mackintosh, and they united in undertaking at the Clyde iron works, in concert with Mr. Wilson, one of the proprietors, a series of experiments to determine this important question.

The fuel made use of at the Clyde iron works, and in Scot-

land, generally, was coke, derived from splint coal.* During its conversion into coke, this coal underwent a loss of 55 parts in 100, leaving 45 of coke.

During the first six months of the year 1829, when all the cast iron in Clyde iron works was made by means of the cold blast, a single ton of cast iron required for fuel to reduce it, 8 tons 1¼ cwt. of coal, converted into coke. During the first six months of the following year, while the air was heated to near 300° Fahrenheit, one ton of cast iron required 5 tons 3¼ cwt. of coal, converted into coke.

The saving amounts to 2 tons 18 cwt. on the making of one ton of cast iron; but from that saving must be deducted the coals used in heating the air, which were nearly 8 cwt. The saving therefore was 2½ tons of coal to a ton of cast iron. But during that year, 1830, the air was heated no higher than 300° Fahrenheit. The great success, however, of these trials induced Mr. Dunlop,† and other iron masters, to try the effect of a still higher temperature. Nor were their expectations disappointed. The saving of coal was greatly increased, insomuch, that about the beginning of 1831, Mr. Dixon, proprietor of Calder iron works, substituted raw coal for coke, proceeding on the ascertained advantages of the hot blast; the attempt was entirely successful, and since that period, the use of raw coal has extended so far as to be adopted in the majority of the Scotch iron works. The temperature of the air under blast had now been raised so as to melt lead, and sometimes zinc, and therefore above 600° Fahrenheit, instead of being only 300°, as in the year 1830.

During the first six months of the year 1833, one ton of cast iron was made with 2 tons 5¼ cwt. of raw coal—add to this 8 cwt. of coal for heating, we have 2 tons 13¼ cwt. of coal required to make a ton of iron; whereas, in 1829, when the cold blast was in operation, 8 tons 1¼ cwt. of coal was used.

The same blowing apparatus was in use during the three successive periods which have been specified, and not the

* Dr. Clark, professor of Chemistry, in Marischal College, Aberdeen.

† Clyde Iron Works.

least remarkable effect of Mr. Nielson's invention, has been the increased efficacy of a given quantity of air in the production of iron. The furnaces at Clyde iron works, which were at first three, have been increased to four, and the blast machinery being still the same, the following were the weekly averages of iron made and coal used, not including that which was used in heating the blast:—

	Tons of Iron.		Tons of Coke.		Tons of Coal.
In 1829, from 3 furnaces,	111	from	403	from	888
1830, .. 3 ..	162	..	376	..	836
1833, .. 4 ..	245	..	—	..	554

being an average of coals used in the furnace to one ton of cast iron—

1829, coke and cold air	8 tons,	1 cwt.,	1 qr.
1830, coke and heated air	5	3	1
1833, coal and heated air	2	5	1

The hot blast has been introduced into many parts of England and Wales, but not with the same extraordinary effect as in Scotland. The quantity of coal consumed in the furnaces, both in England and Wales, being much less than that which is shewn in the foregoing statement as having been used in Scotland before the introduction of Mr. Nielson's patent: this arises from the different quality of the coal; and as the reduced consumption of coal is at the present time its principal advantage, its introduction has not been considered of so much importance; independent of which, a strong prejudice exists with many of the iron masters, against the quality of the iron produced.

It has, however, as we have already observed, great effect on the increase of the manufacture in Scotland.

According to Mr. Finch's statement, there were in 1830, eight works in operation* which made in that year, 37,500 tons of pig-iron.

In 1838, there were 11 works consisting of 41 furnaces in blast, and they made 147,500 tons of pig-iron, being

* At these works there were 24 furnaces, but the statement does not show how many were in blast.

an increase in eight years of 110,000 tons per annum. And in 1839, there were 50 furnaces in blast, making 195,000, or according to Mr. Mushet, 54 furnaces producing 196,960 tons of pig-iron.* Independently of the advantage of the hot blast, the Scotch iron masters are indebted to the excellence of their ironstone called the black-band, or Mushet-stone, it being in the first instance discovered and brought into use by Mr. David Mushet. This gentleman mentions, "the discovery of this stone took place in the year 1801, in crossing the river Calder, in the parish of Old Monkland."†

"For several years after its discovery, the use of this ironstone was confined to the Calder iron works, erected by me in the years 1800, 1801 and 1802, where it was employed in mixture with other iron stones of the argillaceous class. It was afterwards used in mixture at the Clyde iron works, and, I believe, no where else; there existed on the part of the iron trade a strong feeling of prejudice against it. About the year 1825, the Monkland Company were the first to use it alone, and without any other mixture than the necessary quantity of limestone for a flux. The success of this company soon gave rise to the Gartsherrie and Dundyvan furnaces, in the midst of which progress, came the use of raw pit coal and hot blast—the latter, one of the greatest discoveries in metallurgy of the present age, and, above every other process, admirably adapted for smelting the black-band ironstone. The greatest produce in iron per furnace, with the black-band and cold blast, never exceeded 60 tons a-week. The produce per furnace now averages 90 tons per week."

"Instead of 20, 25 or 30 cwt. of limestone formerly used to make a ton of iron, the black-band now requires only 6, 7 or 8 cwt. to the production of a ton. This arises from the extreme richness of the ore, when roasted, and from the small quantity of earthy matter it contains, which renders the operation of smelting the black-band with hot blast, more like the melting of iron than the smelting of an ore. When properly roasted, its richness ranges from 60 to 70 per cent.,

* The quantity is at the present time increased to a considerable extent.

† Papers on Iron and Steel, p. 121 and 127.

so that little more than a ton and a half is required to make a ton of pig-iron; and as one ton of coal will smelt one ton of roasted ore, it is evident that when the black-band is used alone, 35 cwt. of raw coal will suffice to the production of one ton of good grey pig iron."*

From information which we have every reason to believe correct, pig-iron is, in some of the Scotch works, produced at a cost not exceeding 2*l.* per ton. We need hardly point out the effect it must have on many of our works. In North Wales they have already severely felt it, and many furnaces are blown out; it must also be severely felt by many of those works in South Wales, the high character of whose iron will not enable them to withstand its fearful competition. The resources of this Scotch mineral field appear exhaustless in coal,† connected with this valuable ironstone. It does not

* Papers on Iron and Steel—p. 128.

† Extract from the "Remarks on the Mineral Resources of Lanarkshire, by John Craig, Mineral Surveyor, read at the Andersonian Soiree, Dec. 12, 1836."

The coal group consists of thirty-three seams of coal, six or seven of which are generally workable. These are called by different names in different localities. In the following summary I shall adopt the Monkland nomenclature, and give the common thicknesses:—

1st. The Upper Coal, very variable, from 1 to 4 feet.
2d. The Ell Coal, 3 to 4 feet.
3d. The Pyotshaw, 4 feet.
4th. The Main Coal, 5 feet.
5th. The Humph Coal, 1½ to 4 feet.
6th. The Splint or Hard Coal, 2¾ to 4½ feet.
7th. The Virtue Well or Cleland Laigh Coal, 2½ to 4 feet.
8th. The Killtongue Coal, 3 to 4 feet.
9th. The Drumgray Coal, 2½ feet.

These give an average of more than thirty feet of coal. The first of these, and consequently all the others, have been deposited on an area of not less than one hundred square miles, in which I include the thirty-two square miles of new red sandstone, beneath which, save to the south of the deposit, where I consider the red sandstone to extend beyond the limit of the coal group, all the regular coal strata are to be found. The under seams, that is, those below the splint coal, extend to about 140 square miles, exclusive of that portion of them which is overlapped by trap.

The following calculation of the quantity of coal contained in the group I am attempting to describe, is made according to the estimate of Mr. Taylor, before a Committee of the House of Commons:—

The quantity of coal in a square mile of coal 12 feet thick, after leaving one-

however, appear that the manufacture of bar-iron is as yet equally successful, or holds out a prospect of so decided an advantage in price over the Welsh or English, as in the case

third for posts, is 8,200,000 tons. The sum multiplied by 2½ will give the quantity contained in a thickness of 30 feet, viz. 20,500,000 tons. This again multiplied by 100, the number of square miles in which all our coal seams are contained, gives 2,050,000,000 tons. If we take 6 feet as the average thickness of the seams, occupying the remaining 40 square miles, we have, according to Mr. Taylor's calculation, for every square mile, 4,100,000 tons. Multiply this by 40, the number of square miles, and we have 164,000,000 tons; which, added to the former result, gives no less than 2,214,000,000 tons, as the quantity of workable coal contained in what is commonly called the Lanarkshire Coal Basin.

The city of Glasgow, according to the calculation of Dr. Cleland, consumed, including the different manufactories and public works, 561,000 tons in the year 1834.

Allow forty tons a-day each, to twenty-five blast furnaces, and the annual consumpt by these will be 365,000 tons. To these add 200,000 tons, as the annual consumpt of the rest of the inhabitants of the district, and the whole annual consumpt is 1,126,000 tons.

If we divide the quantity by the consumpt, we obtain a quotient of 1,966, as the number of years our common coal fields are capable of supplying a demand equal to that created by the present consumpt of the lower and middle wards of the county.

Ironstones.—The principal ironstones of the upper coal series are—

1st. The Upper Black Band.
2d. Mushet's Black Band.
3d. The Crofthead Black Band. And
4th. The Shotts Coal Ironstone.

1st. The Upper Black Band occurs at Palace Craig, parish of Old Monkland, being the only place where it has been found worth working. It is of inferior quality to Mushet's Band, and is no longer wrought. It is 18 inches thick, and lies about 24 fathoms above the Ell coal.

2d. Mushet's or Monkland Black Band lies about 16 fathoms below the splint coal. It is of very superior quality, measures generally from 14 inches to 18 inches thick, and occupies an area of 9 or 10 square miles in the neighbourhood of Airdrie. It forms the principal supply to Clyde, Calder, Gartsherrie, Dundyvan, Summerlea, and Chapelhall Ironworks.

3d. The Crofthead, or Slaty Black Band, is about the same thickness as the Monkland Band, and is of equally excellent quality. It lies below the coal enumerated as workable, at what distance I cannot precisely say, nor am I able to state in what extent of area it may be found. What is known of it is principally in tack by the Messrs. Holdsworth, of Coltness, who are erecting furnaces for its manufacture into pig-iron. It is found also in the estate of Langside, in the parish of Shotts.

4. The Shotts ironstones overlie the Shotts Laigh coal, and consist of a thin band with excellent nodules, in which occur immense quantities of bivalve shells, scales of fishes, &c.—*J. Craig on the Carboniferous Formation of the Lower Ward of Lanarkshire.*

of pig-iron; the manufacture hitherto has been an expensive process, the iron being tender, and the waste being considerable. An ironmaster looks for his waste in the refinery; the hot-blast iron, besides a considerable waste in the refinery, also suffers in the after and more expensive processes; which, although it is in some measure met by the first cost of the pig-iron, nevertheless has hitherto prevented the Scotch iron-masters from producing cheap bar-iron, or of a quality which will stand competition with a good description of bars, manufactured from the cold-blast pig-iron.

Although the principal advantage of this discovery is at present confined to Scotland, it may, before many years have elapsed, exercise a material influence on the manufacture of iron both in France and America. This observation arises from the circumstance of an ironmaster in South Wales* having with some success, aided by the hot blast, employed the coal called Anthracite, in the smelting of iron. Nearly twenty years back a patent was taken out, and a furnace erected on the borders of Brecknockshire, for the smelting of iron with stone coal (anthracite); many experiments were made with different proportions of the stone coal and bituminous coal used together. The iron produced was of good quality, but the object being to use the anthracite in its raw state, which could not then be effected, the furnace, after a few months' trial, was blown out. In France, also, experiments have been made. M. A. Perdonnet, in his report (1831) on the state of the iron manufacture, says—

"In the blast furnaces of France, carbonized fuel of all kinds has been tried, and the same fuel in a raw state, either wholly or mixed with the other. I will now speak of some experiments made with a curious combustible substance, called anthracite,—a kind of pure carbon, without any mixture of bitumen, compact, igniting with great difficulty, and giving out such a heat, when once in a state of combustion, that it is very difficult to procure materials for the construction of the blast furnaces which will not melt. It has been ascertained that cast-iron cannot be made with anthracite,

* Mr. Crane.

except by excessive care, and that the furnace will not work regular unless three parts of coke be mixed with seven of the anthracite; and indeed, by reason of its burning so slowly, it has been found more advantageous to use them in equal quantities.

The cast-iron obtained with these different proportions of anthracite has always been of excellent quality. This may cause surprise, as the combustible used without preparation as it comes from the mine always contains a large quantity of sulphur."*

Mr. Crane's works are situated on the anthracite formation, and his attention has naturally for many years been directed to the application of it to smelting purposes, but without suc-

* Extract from the Franklin Journal, dated 1st Jan. 1838 :—

Trial made by Merrick and Agnew at the Franklin iron works, Philadelphia, on the comparative use of anthracite coal and gas coke.

" Our cupola is thirty inches in diameter. The blast is urged into it by a fan with four wings, having an aggregate area of 384 inches of fan surface, moving 1800 revolutions per minute through three tuyeres, two of them 4½ inches in diameter and one of 5 inches, the aggregate area being 51½ inches.

" The trial was made in two heats, with each kind of fuel, and the results given are the aggregate of both heats respectively,—

" 1st. Anthracite coal, white ash of very excellent quality.

	hrs.	m.	
Time of blowing 1st heat................	3	15	
2d ,, ...	3	30	
Aggregate....	6	45	or 405 m.

Metal melted 15464 lbs. or 2300 lbs. per hour.
Fuel used .. 3300 ,, 470 ,, to the ton.

" 2d. Coke.

	hrs.	m.	
Time of blowing 1st heat................	1	54	
2d ,, ...	1	18	
Aggregate....	3	12	or 192 m.

Metal melted 14342 lbs. or 4450 lbs. per hour.
Coke used .. 3056 ,, 470 ,, to the ton of iron.

" The weight of fuel used to each ton of iron was precisely the same, but the quantity melted nearly double. Our castings were confined to those not weighing more than from 3000 to 3500 lbs., we should now have no hesitation in undertaking a piece of work weighing from three to four tons, from our cupola using coke as fuel."

cess, until the idea occurred to him that a heated blast, upon the principle of Mr. Nielson's patent, might by its greater power enable him to complete the combustion of this peculiar coal. Mr. Crane, in his report to the British Association (1838) says—

"One evening, after I had placed a piece of the anthracite upon my parlour fire (which had before been made up with bituminous coal), and had allowed it to arrive at a red heat, upon my applying as fierce a blast to this piece of coal as I could raise from a pair of bellows, I noticed the appearance of a black mark or spot upon that part of it where the air impinged upon it; on my continuing the like rapid current, in the same direction, I shortly blew the fire out of it. I at once perceived that the effect of the strength of a current of air, when cold, which we of necessity are obliged to blow into our furnaces to secure the passage of the blast through the high and dense column of materials contained in an erection like a blast furnace, instead of encouraging ignition, was actually unfavourable to it. On giving the thing but a moment's reflection, the question promptly occurred to me, what would be the effect of turning a blast into a furnace upon this coal, which would itself burn—which would itself melt lead? I at once determined that it was a thought which was really worthy of mature reflection. The further consideration which I gave to the matter, and the further experiments which I shortly afterwards instituted have at length been crowned with full success."

Mr. Crane states that on an average of three months he made *the ton of iron with less than twenty-seven cwt. of anthracite coal*, not including the heating of the blast, and that the iron produced was decidedly stronger than any other before smelted at his works.*

The anthracite formation probably occupies about one-third of the mineral basin of South Wales; it commences near the upper part of the vale of Neath, in the county of Glamorgan,

* Mr. Crane has three furnaces, in two of which he uses three-fourths bituminous and one-fourth anthracite; and in the third, a small cupola, he used only anthracite. Other works are being erected in this district.

and proceeds in a westerly direction through the remainder of that county, thence through that of Carmarthen, and crops out in the sea, in St. Budes Bay, after passing through a considerable portion of the county of Pembroke. It is likewise found in France, Austria, Bohemia, and Sardinia, and very large deposits have been already discovered on the continent of America, particularly in the state of Pennsylvania.

It is stated that in the early part of 1840 there were fifty anthracite furnaces at work in America. On the 18th of January of that year, a dinner was given at Pottsville, Pennsylvania, by W. Lyman, Esq., on the occasion of his having successfully introduced the smelting of iron with anthracite by the use of hot blast. Mr. Nicholas Biddle, who attended to witness the result of the experiments, after expressing his entire satisfaction in their success, observes, — " And this, after all, is the great mystery—the substitution of what is called the hot blast for the cold blast. Let us see the changes which this simple discovery are destined to make. As long as the iron ores and the coal of the anthracite region were incapable of fusion, the ores were entirely useless, and the coal nearly unavailable for manufactures, while, as the disappearance of the timber made charcoal very expensive, the iron of Eastern Pennsylvania was comparatively small in quantity and high in price, and the defective communications with the interior made its transportation very costly. The result was that with all the materials of supplying iron in our own hands, the country has been obliged to pay enormous sums to Europeans for this necessary. In two years alone —1836-7, the importations of iron and steel amounted to upwards of twenty-four millions of dollars. The importations for the last five years have been about forty-nine millions of dollars. It is especially mortifying to see that even in Pennsylvania, there has been introduced within the last seven years, exclusive of hardware and cutlery, nearly 80,000 tons of iron, and that of these were about 49,000 tons of railroad iron, costing probably three millions and a half of dollars. Nay, this very day, in visiting your mines, we saw at the farthest depths of these subterranean passages, that the very

coal and iron were brought to the mouth of the mines on rail tracks of British iron, manufactured in Britain, and sent to us from a distance of 3000 miles. This dependence is deplorable. It ought to cease for ever, and let us hope that with the new power this day acquired, we shall rescue ourselves hereafter from such a costly humiliation. We owe it to ourselves, not thus to throw away the bounties of Providence which in these very materials has blessed us with a profusion wholly unknown elsewhere. The United States contain, according to the best estimates, not less than 80,000 square miles of coal—which is about sixteen times as much as the coal-measures of all Europe. A single one of these gigantic masses runs about 900 miles from Pennsylvania to Alabama, and must itself embrace 50,000 square miles, equal to the whole surface of England Proper. Confining ourselves to Pennsylvania alone, out of fifty-four counties of the State, no less than thirty have coal and iron in them. Out of the 44,000 square miles which form the area of Pennsylvania, there are 10,000 miles of coal and iron, while all Great Britain and Ireland have only 2000; so that Pennsylvania has five times as much coal and iron as the country to which we annually pay eight or ten millions of dollars for iron. Again, the anthracite coal-fields of Pennsylvania are six or eight times as large as those of South Wales. Of these great masses it may be said confidently that the coal and the iron are at least as rich in quality and as abundant in quantity as those of Great Britain, with this most material distinction in their favour, that they lie above the water level, and are easily accessible, while many of the mines of England are a thousand or fifteen hundred feet below the surface. With these resources you would have abundant employment, if you could only supply the present wants of the country, for which we are now dependent on foreigners. But the sphere of demand is every day widening for the consumption of iron. The time has come when nothing but iron roads will satisfy the impatience of travellers and the competitions of trade. The time is approaching when iron ships will supplant these heavy,

short-lived, and inflammable structures of wood. We shall not long be content to cover our houses with strips of wood under the name of shingles, prepared for the first spark, if we can have low-priced iron, in which event too, the present pavements of our towns would be superseded by footways of iron. The only difficulty which is suggested is the high price of labour in this country. Allow me to say that I consider this a misapprehension. The high rate of wages is always put forward as the obstacle to any effort to make for ourselves what we import, but I do not believe that it ever made any serious obstacle in practice. I believe, on the contrary, that in any comparison between the price of labour in England and the United States, if we consider not the nominal price paid the labourer, but the amount of work actually done for a given sum of money, and if we regard the English poor-rates, which are only a disguised addition to the rate of wages, we shall arrive at the conclusion that labour is very little, if at all higher in the United States than in England.

"If coal and iron have made Great Britain what she is, if this has given her the power of 400,000,000 of men, and impelled the manufactories which have made us, like the rest of the world, her debtors, why should not we, with at least equal advantages, make them the instruments of our own independence."

Whether these sanguine expectations will be realized, remains to be seen, but at present in this country only one small cupola making about 35 tons per week, is worked with anthracite unmixed with any bituminous coal.

In any inquiry into the probability of injury arising to our manufactures from the competition of foreign countries, particular regard must be had to the facilities of transport, and to the existence in our own country of a mass of capital in roads, canals, machinery, &c.; and also to the cheap rate at which the abundance of our fuel enables us to produce iron, the basis of almost all machinery. It has been justly remarked by M. de Villefosse, that "Ce que l'on nomme en France, la *question du prix des fers*, est, à proprement parler, la

question du prix des bois, et *la question des moyens de communications intérieures par les routes, fleuves, rivières et canaux.*"*

The same writer states the following to be the price of bar-iron at the forges of various countries, in January 1825.

France	£26	10*s.*	per ton.
Belgium and Germany	16	14	do.
Sweden, at Stockholm; and Russia, at St. Petersburg	13	13	do.
England, at Cardiff........	10	0	do.

In France, bar-iron, made as it usually is with charcoal, costs three times the price of the cast iron out of which it is made.

By this statement it appears, that in England it is produced at the least, and in France at the greatest expence. The length of the roads which cover England and Wales, may be stated roughly at twenty thousand miles of turnpike, and one hundred thousand miles of road and turnpike. The internal water communication of England and France, may be stated as follows:—

IN FRANCE.

	Miles in length.
Navigable rivers	4668
Navigable canals	915.5
Navigable canals in progress of execution (1824)	1388
	6971.5†

But if we reduce these numbers in proportion of 3·7 to 1, which is the relative area of France as compared with England and Wales, then we shall have the following comparison:—

* Babbage, Economy of Machinery.

† This table is extracted and reduced from one in the *Ravinet Dictionnaire Hydrographique*, 2 vols. 8vo. Paris, 1824. (Babbage.)

			England.	Portion of France equal in size to England & Wales.
Navigable Rivers		Miles	1,275·5	1,261·6
Tidal Navigation*			545·9	
Canals, direct	2,023·5			
branch	150·6			
			2,174·1	247·4
Canals, commenced				375·1
Total Miles			3,995·5	1,884·1
Population in 1831,			13,894,500	8,608,500†

The commercial legislation of France‡ has been founded, for the most part, on the desire to make that country independent of every other, and to force within itself the production of the principal articles of consumption, in spite of natural difficulties, and without any reference to their cost. This legislation received its greatest encouragement under the Imperial régime, when France was excluded from many of the markets of the world, and when, in order to possess without interruption those objects of luxury which long usage had made necessary, it appeared absolutely needful they should be created by her own industry, or grown on her own soil. And though the cost of so producing was ruinous to the consumer, and, in the long run, scarcely less so to the producer, yet the Government and the people lulled each other with the

* The tidal navigation includes—the Thames from the mouth of the Medway, the Severn from the Holmes, the Trent from Trent-falls in the Humber, the Mersey from Runcorn Gap.

† Babbage.

‡ In 1831, a commission was appointed, consisting of George Villiers, Esq., and Dr. Bowring, to discuss conjointly with the French Government, the commercial relations between Great Britain and France. Mr. Poulett Thomson, President of the Board of Trade, in his letter of instructions, says :—

"There are several articles of vast importance, such as *iron*, cotton manufactures and others which are the subjects of a ruinous system of legislation; but though it is obvious that a reduction of duty on them would be as important to England as advantageous to the general interests of France, yet the opposition to such an amelioration would be so powerful, that you would probably find it vain to contend against it at the present moment, and it may be only by degrees that it will be possible to introduce material alterations in this particular."

fallacy, "that the cost mattered not, as the money was spent in the nation, and the wealth of France was not expended on foreigners."

The fact, however, cannot be denied, that many of the efforts made by France to produce the commodities she had been accustomed to import, were forced upon her by her isolation, into which she was thrown by the naval superiority of Great Britain. But these efforts, however well suited to the peculiar exigencies of the time, and however creditable to the ingenuity of those who exerted them, necessarily flung the capital of France into false and unfavorable positions. When the return of the Bourbons opened to France the commerce of the world, so many interests had been created, so much labour and wealth were engaged in the production of articles which might have been more economically imported, that it was found difficult suddenly to change the legislation which gave to the French producers the benefit of a monopoly, without which they would have fallen; and their fall would inevitably have brought with it much suffering and distress.*

In France, as has already been observed in the Introduction to this work, "a very large proportion of those who are interested in the continuance of the existing commercial system, are elevated public functionaries, or are placed in immediate contact with them." It would have been idle, therefore, to have attacked great monopolies in their strongest holds. Nor can it be denied, that some of the protected manufactures are of such magnitude as to demand attention and respect. In many of them, considerable numbers of workmen are engaged; and though their employment in protected fabrics leads to the exclusion of a far more considerable number of labourers in those branches of industry whose cultivation would be the natural, instead of the forced growth of capital, yet all serious shiftings or transfer of labour, cannot but involve questions of difficulty and deep concern. In the meantime, the labouring classes, impatient of the suffering which is of necessity consequent upon the changes which

* Report on the Commercial Relations between France and Great Britain, p. 1.

every alteration of the tariff brings with it, naturally ally themselves with their manufacturing masters, who demand the exclusion of the foreign articles which are in competition with their own.*

It is quite clear, that those high prices which it is the design of a protecting system to create, are wholly incompatible with an extended foreign trade; for though a Government may force its own dependents to purchase a dear or an inferior commodity, because it is national, no Government can compel an independent nation to buy a foreign commodity that is costly or bad. A protective system necessarily relinquishes the markets of the world for the home market, or, if not, the public (already overcharged for the protected articles of its own consumption) must be made to pay, in the shape of premiums on exported articles, the whole difference of price to the foreign consumer, between those articles, and the similar ones which come into competition with them.†

The history of French prohibition is that of a struggle to obtain what is inaccessible, without a violation of those laws by which capital and labour should properly be governed; in other words, it is the rejection of those natural advantages which are at the command of industry, in order to acquire advantages which, after all, are denied to it. The wines of France, for instance,‡ afford unbounded means of exchange,

* Report, p. 8. † Ib. p. 16.

‡ J. Bowring, p. 167, Appendix, Second Report, 1834.

Address of the Merchants of Bordeaux, to the Legislative Chambers.—Necessity of a Commercial Reform.

"What shall we say of iron and cast-iron which has not been repeated to satiety for years? We regard their prohibition as the chief cause of the decline of our city and of its commerce. The nations where iron appears the principal production were, in effect, precisely those which consumed the most of our productions. As an object of universal necessity, it is inconceivable that a great nation should submit to pay treble the value of a metal which her neighbours offer in exchange for commodities with which she overflows.

"If the mines of Aveyron present us already a slight diminution in the price, and lead us to hope for one more considerable, we must not forget that the expence of production is double the cost of English iron, and its transport from the mines in ships to Bordeaux two-thirds dearer than the freight from England to Bordeaux. Now let any one judge of the disadvantages which will always result to us in being obliged to supply ourselves from the produce of Decazeville, seeing that the company,

and its consequent benefits have hereby been sacrificed to iron, which is produced only at extravagant cost, and which, when produced, is valueless, in consequence of its high price, for all purposes of foreign trade. With her iron France can buy nothing that is not French; the same with a great proportion of her cotton and her woollen manufactures; her wines open to her all the markets of the world.*

The annual sacrifice made by the agriculturists to the protected ironmasters, has been frequently allowed to be not less than from 1,500,000*l.* to 2,000,000*l.* sterling per annum. The lands cultivated in France are supposed to amount to 22,818,000 hectares, equal to 57,045,000 acres English; and it is calculated that a team of oxen would cultivate 15 hectares: hence, the quantity of ploughs employed in France are estimated at about 1,500,000. M. de la Rochefoucault represents the annual use and waste of iron at 40 kilogrammes per team; but it has been frequently estimated at 50 kilogrammes; making, for the whole consumption, 75,000,000 kilo-

in order to fabricate iron of a superior quality, is obliged to procure cast-iron from England, and to melt it again, at considerable expence at their works, situated 100 leagues from the sea. Here are facts which pass before our eyes, and which speak more loudly than the most skilful arguments in favour of our deplorable system of protection. France ought now to see if she can reckon upon her own resources, and whether it is not time to restore the ancient relations which caused the prosperity of her southern districts, by freely admitting the products of nations which offer her such advantageous exchanges. We think, then, that it is urgent, if financial considerations, of which we are not qualified to judge, do not allow a complete abolition of duties on iron, that our tariffs should be reduced to the most moderate rate, and that iron should be admitted almost free at all times when its importation shall be justified by the wants of any enterprise of public interest, such as railroads, canals, suspension bridges, &c. This advantage is a matter of right from the instant that the increase of the public means of activity and general prosperity becomes concerned. Our maritime position induces us to turn our attention to anchor and chain cables, which we receive from England. The first pay from 11fr. to 16fr. 50c. per 100 kil. This duty is an additional tax upon our navigation, as if it had not to struggle already against too many disadvantages. English large anchors of a superior quality, and better made than ours, are almost indispensable for large ships: chain cables being prohibited, we cannot make any observations upon the duty paid. They are smuggled: but we are too well assured of the repugnance experienced by those who are obliged to have recourse to this extremity, not to call for a change which may relieve them from that unpleasant position."

* Report, p. 27.

grammes of iron, which, at 90 francs per 100 kilogrammes, consumes 67,500,000 francs, equal to 2,700,000*l.* sterling. Now, though this estimate is too high for an average calculation, it is undeniable that the iron could be imported from foreign countries at half the price; and the loss to agriculture alone must be taken at above one million sterling per annum. The annual consumption of France cannot be estimated at less than 160,000 tons of iron. The average difference of price between France and England has been for the last twenty years more than 10*l.* per ton. The smallest annual loss is therefore 1,600,000*l.* The law of 1822 has been more than ten years, that of 1814 was eight years in operation. They have cost the French people above 30,000,000*l.* sterling in positive and direct sacrifice of the national wealth, and double that amount in indirect sacrifice. The relative prices of French and English iron are now far more remote than they were when the protective system was called into its present active operation. Ruinous losses have attended many of the iron-making adventurers; the largest of the iron companies have become bankrupt, and so far from the protecting experiment having produced the consequences anticipated by its advocates, we shall be enabled to show that its failure has been as signal as its cost has been enormous.*

The ship-owners, also, represent that one of the main causes of their non-progressive state is the burdens entailed on them by the restrictions of the French commercial system. The shipping of France, they report, consists of about 11,000 vessels employed in foreign commerce and fisheries. They calculate that 102 metrical quintals of iron are employed per 250 tons: hence 1,122,000 cwts. of iron are in use in the French commercial shipping; at 56fr. (*Enquête sur les Fers*, p. 53), its value would be 62,832,000fr. It is believed that the annual waste is about 10 per cent., say 6,283,200fr., of which more than half,† they state, is sacrificed by the shipping

* First Report on the Commercial Relation between France and Great Britain—1832, p. 28.

† The *Enquête sur les Fers*, p. 52, gives 22fr. 40c. per quintal, as the average price of English iron, from 1816 to 1828.

interests to the ironmasters of France, whose monopoly, at the same time, leads to an enormous increase in the value of timber.*

While, on the other hand, the revenue is diminished by the operation of the restrictive system, the expenses of the State are increased on the other, wherever purchases are made for the public service, of articles whose price has been increased by protecting duty. The annual purchase of iron in France, for instance, for the naval and military services, amounts to 10,000,000fr., of which considerably more than half would be saved, if foreign iron were admitted at a moderate duty.†

The same observations as on the French restrictions may be applied to America. These are the only rivals with whom we have to contend, and even with respect to these, it is only in their own markets, where the manufacture is protected at the expence of the consumer. After the year 1842, however, our iron will be admitted into America at a moderate duty; and at the present time, rail-iron is admitted there, under certain regulations, *duty free*.

By an Act passed on 14th July, 1832, for all iron imported for railroads or inclined planes, by any *State or Incorporated Company*, bond is to be given for the duty as usual, and the same shall be actually laid down, the drawback shall be allowed, or if actually paid, refunded. Provided no iron shall be considered railroad or inclined plane iron, but such as is prepared to be laid down *without further manufacture*. It further enacts, that the secretary of the treasury may extend the time for paying the duty bonds from time to time, *not exceeding three years*.

And if the company has paid the duty the treasury will refund it, upon their giving bond to repay it if the *iron is not laid down within three years*.

And a certificate from the collector, of the time and quantity of import, and another certificate of its being laid down within the three years, are required, either to cancel the bond or recover the drawback.‡

* Report, p. 34. † Ibid. p. 38.

‡ Railroad iron, as taken at the Custom House, entitled to drawback:—Bars or rails, pedestal washers, splicing plates, flat clamps, narrow and broad.

The great advantages possessed by our own country are of a nature not to be injured by any foreign manufacture. Our works are situated on mineral fields containing coal and ironstone in abundance, both of which can be raised at a moderate cost. Fire-clay is also found in the same ground, and limestone in the immediate neighbourhood of all the mines. This may occur in particular situations in other countries, but even where it does, there are not the same facilities which we possess of conveying at a moderate rate the manufactured iron to the different markets for exportation or home consumption.

It is truly astonishing, when we look back and consider in how few years the iron manufacture has arrived at its present vast extent, and that this rapid increase has occasioned no heavy accumulations of stock;* the iron trade, in common with all other trades, feels the effect of any general stagnation, but not from over production—as with its growth new channels of consumption have kept pace. The endless detail into which the foundry trade branches itself, the almost universal fabrication which it embraces, consumes a very large proportion of the make: in buildings, iron is becoming a very general substitute for wood; railroads may also be particularly mentioned as consuming a very considerable quantity of

* As in the following instance, the ironmasters have occasionally, during a temporary cessation of demand, entered into an agreement to reduce the make, rather than lower the price.

In December 1836 the ironmasters of South Wales called a meeting of the trade, at Newport, and agreed to the following resolutions:—

"That the make of pig-iron be reduced 20 per cent."

"That the reduced make be persevered in till the 31st March, 1837."

"That the price of iron be continued at £10 per ton."

The iron-masters present agreed to blow out twenty-two furnaces, and to meet, by a reduction of make in their remaining furnaces, the specified quantity required of them of the one-fifth proposed to be reduced—to be calculated on the make of the previous twelve months.

The Staffordshire, Shropshire, North Wales, and Scotch ironmasters were requested to join in this arrangement, to which they acceded.

Again, in 1840, there was an agreed reduction in the make, of 20 per cent, to remain in force from 22d Feb. to 1st July.

At a meeting of the Staffordshire ironmasters in March in the same year, an interesting paper was read, relative to the source and strength of the Staffordshire

manufactured as well as cast iron, but principally the former. It would be endless to shew where it has been, within a few years introduced, but we cannot omit noticing its recent application to the building of ships. The success attending these first trials cannot but lead to the conclusion, that for the future, ships will very generally be made of iron instead of wood, and if so, what a field it opens to the ironmaster, and how greatly it will add to the consumption. The plates of which the ships will be built must necessarily be of a very superior description of iron, involving a greater waste, and consequently increasing the consumption of the pig-iron; and those works must be benefited, the quality and character of whose iron stands high—as, where the safety of hundreds or thousands of individuals is at stake, the very best iron alone should be used.

With increased facilities of procuring iron at a reasonable price, America, and also France,* provided that in this latter

Iron Trade. By which it appeared that there were 581 puddling furnaces, consuming weekly 7262½ tons of pigs.

The make of pigs in 1839 was	338,737 tons.	
Deduct, as agreed upon, 20 per cent.	67,747 ,,	
	270,990 ,,	
which is equal to per week	5211 tons.	
Deduct used in castings and foundry purposes	1400 ,,	
	3811 ,,	to which quantity add
Shropshire, Welsh, and other pigs used in Staffordshire........................	1000 ,,	

There are left 4811 tons of forge pigs as a weekly supply for the puddling furnaces.

The consequence is, the stocks accumulated during the late stoppage are rapidly decreasing, and prices therefore must keep up.

* The duties were to be taken into consideration in 1840; but the commercial treaty lingered till the misunderstanding between this country and France, on the affairs of the East, seems to have stopped it for an indefinite period.

In answer to a question on this subject from Lord Strangford, who stated his conviction was, that nothing could tend more to the prosperity of the empire than the establishment of a fair and liberal system of commercial intercourse between this country and France:

Lord Melbourne said, that negotiations had been in progress on this subject up to a few months ago, and they had been brought to such a point that there was every reason to hope for a speedy and successful termination of them. Circumstances,

country the duties are reduced, will become large purchasers; and our iron-trade, unlike many of the other manufactures, being altogether the production of our own soil, will continue to give employment to hundreds of thousands of our population, to the great advantage of the country at large, as well, we trust, as the individual benefit of the ironmaster.

however, had taken place in the last year, interrupting the negociation, which had not since been renewed. The misunderstanding was now, however, at an end, and there was every reason to hope that the negociation would be renewed, and that it would lead to an arrangement between the two countries, which would promote the interchange of their respective productions to the great benefit of both.—The *Times*, 27 March, 1841.

APPENDIX.

APPENDIX.

NOTES TO CHAPTER II.

1. Ship-building, and the founding of iron cannon, were the sole manufactures in which the English excelled in James the First's reign. They seem, indeed, to have possessed alone the secret of the latter, and great complaints were made every Parliament against the exportation of English ordnance.—*Appendix to Hume's History of Great Britain.*

2. Charles the First, in 1637, by proclamation, ordered the pigs and bars of iron made in England to be marked by his surveyors of the iron works, to prevent the sale of bad iron, and that iron was not to be exported without the king's licence, under pain of forfeiture, &c. Those surveyors were also empowered to enter any woods that were felled, cut or corded, to be converted into coal for making of iron, whereby it might appear of what condition those woods were that should be employed that way, and that they be not cut down contrary to law.—*Macpherson's Annals of Commerce.*

3. 1661.—A petition from persons connected with the manufacture of iron was presented to the House, praying that a duty might be put upon foreign iron ; it was referred to a committee, who reported that they were of opinion that the whole imposition upon all foreign iron, except Spanish, be 40*s.* per ton. It was negatived in the House.—*Journals of the House of Commons.*

4. 1679.—A duty of 10*s.* per ton was laid upon all foreign iron imported.—*Ibid.*

5. 1681.—Andrew Yarrington, in a work entitled "England's Improvement by Sea and Land," asserts that tin plates (iron plates tinned over) were now made in England through his means, he having learnt the art of making them in Bohemia. Little was at this time done in this manufacture; in the year 1720 it was one of the many projects set afloat, and, in 1740, it was brought to considerable perfection.

6. 1685.—Manufacture of fine ironmongery in England improved by French refugees.

7. 1689.—A petition of divers freemen of London was presented to the House, praying that the importation of iron wire might be allowed.—*Journals of the House of Commons.*

8. 5th William and Mary, c. 17, an Act was passed for the exportation of iron, &c., setting forth that, "Whereas, by several statutes, the one made in the 28th year of Edward III., and the other in the 33d year of Henry VIII., and another in the 2d year of Edward VI., iron, copper, &c., are prohibited to be exported out of this realm, under several penalties, in the said statutes respectively contained:

"Be it, therefore, enacted, &c., that from and after the 25th March, 1694, it shall be lawful to ship and export all manner of iron, &c., except unto and for the use of the French king, or any of his subjects residing within his dominions, &c., during the present war."

9. The ingenious William Chetwyord, of Rugely, Esq., at Madely furnace, cast iron rollers for gardens, hollow, like the mills for sugar canes, of 5, 6, 7, or 800 weight a-piece; the hollow whereof being filled with timber, and wedged up close, the other iron work of the roller is fastened to the wood in the same place as in other rollers, which are weightier and more substantial than any other rollers I have elsewhere seen. For such purposes as these, this serves well enough, but for others it will not, for it is so brittle, that, being heated, with one blow of a hammer it will break all to pieces.—*Plott's Nat. History of Staffordshire*, 1686.

10. In the early part of the eighteenth century, John Hanbury invented the method of rolling iron plates by means of cylinders, and introduced the art of turning into England.—*Coxe's Tour in Monmouthshire.*

11. In 1720, celebrated in the annals of our history for the great South Sea speculation, among the many projects of that

year, Mr. W. Wood, a great iron proprietor, endeavoured to establish an iron partnership, or company. Mr. Wood had then a lease of all the mines on the crown lands of thirty-nine counties—some of the best iron works in the kingdom; several forges for refining and drawing iron into bars; also a mill, for rolling, slitting, and preparing the iron for its several uses in manufactures, furnaces for making pig-iron, pots, rails, and banisters, backs and hearths for chimneys, and all other sorts of cast-iron. With a view to introduce his scheme, he wrote a pamphlet, to prove that England possessed within herself all the essentials to the manufacture of iron. He observes—

"That the iron manufacture, next to the woollen manufacture, is the most considerable of all others in this nation. That we then used about 30,000 tons of iron per annum, of which, for want of a sufficient supply of cord wood, we are forced to buy of our neighbours about 20,000 tons, with ready money, which, at 10*l.* per ton, is 200,000*l.* per annum. That we have ironstone enough, and may be able to supply ourselves with cord wood to make the greater part, if not the whole, of the iron we want, by planting and raising coppices on waste, and other lands of small value, and laying down a certain quantity of acres for the growth of timber trees."

The distress which ensued on the bursting of the South Sea bubble, put a stop to all the other schemes of the day, and Mr. Wood's iron partnership was not carried into effect.

APPENDIX A.*

Copies of the certificates transmitted to the Commissioners for Trade and Plantations by the Governors, Lieutenant-Governors, or Commanders-in-Chief of his Majesty's Colonies in America, in pursuance of an Act of the 23d of his present Majesty's reign, containing accounts of any mill or engine for slitting or rolling of iron, and any plating forge to work with a tilt

* Page 73.

hammer, and any furnace for making steel, erected in any of his Majesty's Colonies in America.

	Mill or engine for slitting or rolling iron.	Plating forge to work with a tilt-hammer.	Furnace for making steel.
Maryland ...	......	1, with 2 tilt-hammers	——
Pennsylvania	1	1	2
New Jersey..	1, not now in use	1, not now in use....	1 ditto
New York ...	......	1, ditto	——
Connecticut ..	......	1..1..1..1..1..1..	1
Massachus. B.	1..1	1	1

APPENDIX B.*

Navy Office, 8*th March*, 1736.

Copies of the several Reports made to the Commissioners of the Navy, by the Officers of his Majesty's yards, of the tryals of iron imported from the plantations, prepared pursuant to an order of the Honourable House of Commons of the 4th instant.

Copy of a letter from the officers of his Majesty's yard at Deptford, to the Navy Board, dated the 3d October, 1735 :—" Having, in obedience to your warrant of the 11th July last, received from Mrs. Crowley about six tuns of the bar-iron of different sorts which she lately imported from America, we sent one tun thereof to each of the other yards, and have made a strict and careful survey and tryal of the sorts that remained, by causing several bars to be broke cold, and others wrought into bolts and hoops, seeing them drove very tight, by which the said iron appears to be a good tough sort, and fit for the service of the navy. We are, therefore, of opinion, it is equal in goodness to the first sort of Arground's Sweeds iron, and worth the same price, namely—17*l*. 10*s*. a tun."

Copy of a letter from the officers of his Majesty's yard at Deptford, to the Navy Board, dated 23d February, 1736 :—" Pursuant to your order of the 17th instant, we pray leave to acquaint you, that the tun of American iron imported by Mrs. Crowley, and directed to this yard for an experiment, has been wholly wrought up, and applied to such uses for which it was most fit, as hoops, bolts, &c., and were carefully surveyed in making and driving, as we acquainted your honours in our report of the 3d October last; and we continue of the same opinion of its goodness and value.

* Page 75.

Copy of a letter from the officers of his Majesty's yard at Chatham, to the Navy Board, dated the 8th September, 1735 :—" In obedience to your warrant of the 11th of July last, we have received and made tryal of Mrs. Crowley's iron, imported from America, which we have wrought—the flatts into strakes for timber carts, horse-shoes, for mooring collars, scrapers, and sockets for scavel men, and mast hoops—the squares into tackle hooks, cart nails, and several sorts of bolts; and, upon working the same, it appeared to be very tough, and in every respect equal in goodness and value to the best Sweeds iron."

Copy of another letter from the officers of his Majesty's yard at Chatham, to the Navy Board, dated the 23d February, 1736 :— "The tun of American iron of Mrs. Crowley's, sent to this yard for a tryal of its goodness, was all worked up into bolts, tackle hooks, strakes, and nails for cart wheels, &c., as we acquainted you by our letter of the 8th September last, since which the bolts have been used, and drove very well; the tackle hooks have been tryed as usual, and stood the strain of a fourfold tackle, and the strakes and nails that were put upon cart wheels are still remaining on them, and in good order—none of the heads of the nails having broke, and we have had no complaints of any of the other particulars mentioned in our letter that were made of the said iron, all which confirms us in our opinion that it is tough in its nature, and equal in goodness and value to Sweeds iron."

Copy of a letter from the officers of his Majesty's yard at Sheerness, to the Navy Board, dated 26th February, 1736 :—" As we are ordered by your warrant of the 8th August last, to cause the tun of Mrs. Crowley's American iron, sent hither from Deptford, to be worked up, we humbly acquaint you, in answer thereto, and to your order of the 17th instant, that, as the service here has called for the sorts that were sent us, which were flatts of two and a quarter inches broad, and half an inch thick, and squares of seven-eighths of an inch, those sorts have been used, and about one third part of the whole converted to boom iron, square staples, bolts, and thimbles; in the making of them the iron proved very extraordinary, and the bolts that have been drove, which is the only proof we have had of it, proves equal to the best Sweeds iron, and in our opinion is of equal value."

Copy of a letter from the officers of his Majesty's yard at Portsmouth, to the Navy Board, dated 24th February, 1736 :—" In

obedience to your directions of the 24th September last, we have caused the tun of iron, imported from America by Mrs. Crowley, to be wrought up, which we found to be very tough, not any ways coldshire, but two or three of the bars in working proved a little redshire. It is equal in goodness to the best Sweeds iron that hath at any time been received into his Majesty's stores here; and is, in our humble opinion, worth 17*l.* 10*s.* per tun."

Copy of a letter from the officers of his Majesty's yard at Plymouth, to the Navy Board, dated 22nd February, 1736:—"Obedient to your directions of the 17th, have to acquaint you, that from the several tryals we have had from the tun of iron imported by Mrs. Crowley from America, it is both in the nature and goodness and value in all respects with Sweeds iron."

Copy of a letter from the officers of his Majesty's yard at Deptford, to the Navy Board. dated 20th September, 1735:—"Mrs. Crowley having sent hither the Philadelphia and Maryland iron, mentioned in your honours' warrant of the 26th May last, we have surveyed the same, found no marks thereon to distinguish one sort from the other, but broke several bars of each sort, and finding most part of the said iron to be brittle, with a grain like cast iron, or pott mettle, and no ways fit for his Majesty's service in this yard, we returned the whole quantity to Mrs. Crowley again."

Copy of a letter from the officers of his Majesty's yard at Woolwich, to the Navy Board, dated 3d September, 1735:—"We have lately received from his Majesty's yard at Deptford, barr-iron flatts of two and a quarter inches broad, and half an inch thick—15 cwt. 0 qr. 4 lbs., squares of seven-eighths of an inch—5 cwt. 0 qr. 12 lbs., imported by Mrs. Crowley from America; and, pursuant to your warrant of the 11 July, 1735, have made sufficient tryal of each of the sorts, find the said iron to be very good, and fit for his Majesty's service, superior in every respect to the best Sweeds iron, and, in our opinion, worth 17*l.* 10*s.* 6*d.* per tun."

The following are Parliamentary Tables of Imports and Exports of Iron and Steel, from the year 1710 to the year 1776.

These returns, ordered by the House of Commons at different times, have reference principally to the trade and encouragement of the manufacture of iron, in our American Colonies.

TABLE I.

AN ACCOUNT OF THE QUANTITY OF IRON IMPORTED INTO ENGLAND FROM CHRISTMAS, 1710, TO CHRISTMAS, 1718, FROM FOREIGN COUNTRIES,

With Duties payable thereon, and how much the same amounted to, distinguishing each country and each year.

FROM CHRISTMAS, 1710, TO CHRISTMAS, 1711.

	London.				Out Ports.				Total of both.				Amount of Custom.		
COUNTRIES.	*T.*	*c.*	*q.*	*lb.*	*T.*	*c.*	*q.*	*lb.*	*T.*	*c.*	*q.*	*lb.*			
Denm. & Nor.	15	8	3	17	35	5	0	5	50	13	3	22	£114	19	4
E. Country ..	48	8	1	0	116	15	0	8	165	3	1	8	342	15	10
France	..		..		..		..		..		..		..	..	
Germany	581	4	0	22	167	5	0	1	748	9	0	23	1,569	5	5
Holland	..		..		237	15	1	13	237	15	1	13	493	10	4
Ireland	..		..		174	5	0	19	174	5	0	19	173	17	11
Portugal	0	12	1	21	..		..		0	12	1	21	1	11	8
Russia	..		..		..		..		..		..		..	..	
Spain.	869	7	3	22	470	6	3	13	1339	14	3	7	3,370	7	3
Sweden......	5890	19	2	21	5962	3	3	16	11853	3	2	9	25,164	11	7
Guernsey	..		..		14	3	3	7	14	3	3	7	29	8	11
Jersey	..		..		..		..		..		..		..	..	
Totals ..	7406	1	1	19	7178	0	0	26	14584	1	2	17	31,260	8	3

1711-1712.

Denm. & Nor.	280	14	1	11	89	8	3	24	370	3	1	7	£828	9	1
E. Country ..	55	16	0	0	1465	13	2	14	1521	9	2	14	3,156	18	0
France	..		..		..		..		..		..		..	..	
Germany	563	5	1	22	111	3	2	9	674	9	0	3	1,407	15	4
Holland	..		..		182	17	0	18	182	17	0	18	379	10	11
Ireland	..		..		7	2	3	26	7	2	3	26	7	0	8
Portugal	..		..		..		..		..		..		..	..	
Russia	..		..		..		..		..		..		..	..	
Spain	594	4	1	0	589	6	2	15	1183	10	3	15	2,968	4	9
Sweden......	7627	12	2	18	5681	2	3	4	13308	15	1	22	27,913	10	11
Guernsey	1	19	1	0	48	6	2	1	50	5	3	1	104	7	5
Jersey	..		..		..		..		..		..		..	..	
Totals ..	9123	11	3	23	8175	2	0	27	17298	14	0	22	36,765	17	1

1712-1713.

Denm. & Nor.	182	10	2	7	138	2	1	19	320	12	3	26	£664	1	3
E. Country ..	121	5	1	14	141	15	1	0	263	0	2	14	545	18	9
France	..		..		..		..		..		..		..	..	
Germany	257	16	2	7	339	13	0	12	597	9	2	19	1,240	4	4
Holland	48	7	3	5	71	13	3	16	120	1	2	21	249	4	11
Ireland	..		..		45	4	3	16	45	4	3	16	45	3	0
Portugal	..		..		..		..		..		..		..	..	
Russia	..		..		..		..		..		..		..	..	
Spain	240	1	1	14	1021	4	3	2	1261	6	0	16	2,742	17	7
Sweden......	4565	6	3	8	6892	2	2	19	11457	9	1	27	24,191	13	5
Guernsey	..		..		16	1	2	0	16	1	2	0	33	7	1
Jersey	11	18	1	0	3	16	1	9	15	14	2	9	32	12	10
Totals..	5427	6	2	27	8669	14	3	9	14097	1	2	8	29,745	3	2

TABLE I. (*continued.*)

1713-1714.

Countries.	London. T.	c.	q.	lb.	Out Ports. T.	c.	q.	lb.	Total of both. T.	c.	q.	lb.	Amount of Customs.		
Denm. & Nor.	248	0	0	18	97	2	0	17	345	2	1	7	£733	13	1
E. Country ..	125	15	1	22	159	17	0	17	285	12	2	11	384	16	2
France	3	13	0	0	..		..		3	13	0	0	16	0	6
Germany	359	5	1	13	315	12	3	20	674	18	1	5	1,400	17	6
Holland	..		..		61	13	3	13	61	13	3	13	128	1	0
Ireland	..		..		37	3	1	24	37	3	1	24	37	1	10
Portugal	..		..		..		..		..		..		..	..	
Russia	..		..		13	0	0	0	13	0	0	0	26	19	8
Spain	252	17	0	17	467	15	0	7	720	12	0	24	1,553	10	8
Sweden......	12002	19	3	18	7751	2	1	15	19754	2	1	5	41,049	17	0
Guernsey	..		..		..		..		..		..		..	..	
Jersey	..		..		3	1	1	0	3	1	1	0	6	7	1
Totals..	12992	11	0	4	8906	8	1	1	21898	19	1	5	45,337	4	6

1714-1715.

Countries.	London. T.	c.	q.	lb.	Out Ports. T.	c.	q.	lb.	Total of both. T.	c.	q.	lb.	Amount of Customs.		
Africa	..		..		..		..		..		..		..	..	
Denm. & Nor.	402	17	1	0	148	6	0	12	551	3	1	12	£1,165	10	5
E. Country ..	83	6	0	0	72	16	3	1	156	2	3	1	341	2	3
Flanders	..		..		20	5	0	21	20	5	0	21	42	1	0
France	..		..		..		..		..		..		..	..	
Germany	93	13	0	0	391	8	2	24	485	1	2	24	1,007	7	4
Holland	..		..		522	14	1	12	522	14	1	12	1,083	4	4
Ireland	..		..		40	1	3	14	40	1	3	14	40	0	4
Italy	..		..		..		..		..		..		..	..	
Portugal	..		..		..		..		..		..		..	..	
Russia	..		..		..		..		..		..		..	..	
Spain	303	13	3	21	1005	4	1	17	1308	18	1	10	2,843	8	4
Sweden......	8266	16	0	2	6278	4	0	21	14545	0	0	23	30,621	15	0
Guernsey	..		..		..		..		..		..		..	..	
Jersey	..		..		22	11	3	7	22	11	3	7	46	15	9
Totals..	9150	6	0	23	8501	13	1	17	17651	19	2	12	37,191	4	9

1715-1716.

Countries.	London. T.	c.	q.	lb.	Out Ports. T.	c.	q.	lb.	Total of both. T.	c.	q.	lb.	Amount of Customs.		
Africa	..		..		..		..		..		..		..	..	
Denm. & Nor.	178	12	3	0	281	3	0	25	459	15	3	25	£979	0	11
E. Country ..	8	1	3	0	65	6	2	24	73	8	1	24	153	1	9
Flanders	..		..		..		..		..		..		..	..	
France	..		..		..		..		..		..		..	..	
Germany	37	12	2	7	242	18	3	23	280	11	2	2	582	11	8
Holland	..		..		245	5	1	27	245	5	1	27	509	1	10
Ireland	..		..		2	5	1	1	2	5	1	1	2	4	3
Italy	..		..		..		..		..		..		..	..	
Portugal	..		..		4	4	1	7	4	4	1	7	8	14	11
Russia	30	0	0	0	44	6	0	0	74	6	0	0	154	4	3
Spain	795	14	0	15	954	13	2	27	1750	7	3	14	3,886	6	7
Sweden......	7604	17	3	7	4283	13	1	0	11888	11	0	7	25,061	4	5
Guernsey	5	10	0	0	18	0	2	22	23	10	2	22	48	17	1
Jersey	..		..		25	4	1	0	25	4	1	0	52	6	7
Totals..	8660	9	0	1	6167	1	3	16	14827	10	3	17	31,437	14	3

TABLE I. (*continued.*)

1716-1717.

Countries.	London. T. c. q. lb.	Out Ports. T. c. q. lb.	Total of both. T. c. q. lb.	Amount of Customs.
Africa	4 4 1 14	.. ..	4 4 1 14	£8 15 1
Denm. & Nor.	247 2 2 0	124 9 3 18	371 12 1 18	783 3 1
E. Country ..	3 17 3 0	39 2 0 2	42 19 3 2	16 2 7
Flanders	107 13 2 19	5 10 0 0	113 3 2 19	254 4 8
France	.. ..	3 17 0 0	3 17 0 0	7 19 10
Germany	398 8 1 19	74 12 2 5	473 0 3 24	919 14 6
Holland	1478 9 2 22	450 17 1 9	1929 7 0 3	4,004 13 0
Ireland	8 1 2 0	209 9 3 1	217 11 1 1	217 2 2
Italy	.. ..	.. ..	.. ..	.. ..
Portugal	.. ..	.. ..	.. ..	.. ..
Russia	166 7 1 2	5 2 2 26	171 10 0 0	355 19 5
Spain	1368 5 2 15	1375 17 3 14	2744 3 2 1	5,986 18 6
Sweden......	1020 19 3 0	406 13 0 7	1427 12 3 7	3,184 1 2
Guernsey	6 14 2 0	18 15 3 14	25 10 1 14	52 19 4
Jersey	.. ..	15 14 1 0	15 14 1 0	32 12 3
Totals..	4810 5 0 7	2730 2 1 12	7540 7 1 19	15,824 5 7

1717-1718.

Countries.	London. T. c. q. lb.	Out Ports. T. c. q. lb.	Total of both. T. c. q. lb.	Amount of Customs.
Africa	2 16 0 0	.. ..	2 16 0 0	£5 16 2
Denm. & Nor.	734 15 3 0	320 3 0 11	1054 18 3 11	2,191 8 0
E. Country ..	3076 1 0 3	1257 11 3 21	4333 12 3 24	9,036 17 9
Flanders	218 11 0 24	7 9 1 13	226 0 2 9	498 2 4
France	21 2 2 0	13 5 3 10	34 8 1 10	120 5 9
Germany	180 19 1 14	434 12 0 4	615 11 1 18	1,284 13 10
Holland	3687 17 1 26	4242 14 0 25	7930 11 2 23	16,460 18 3
Ireland	35 0 0 0	370 14 3 6	405 14 3 6	407 17 11
Italy	3 17 3 0	.. ..	3 17 3 0	8 1 4
Portugal	.. ..	.. ..	.. ..	.. ..
Russia	237 5 1 19	97 3 2 10	334 9 0 1	699 5 9
Spain	1013 9 1 25	1178 19 3 9	2192 9 1 6	4,704 2 0
Sweden......	74 11 0 0	.. ..	74 11 0 0	154 14 8
Guernsey	.. ..	19 9 1 15	19 9 1 15	23 16 4
Jersey	.. ..	7 15 3 14	7 15 3 14	16 3 5
Totals..	9286 6 3 27	7949 19 3 26	17236 6 3 25	35,612 3 6

DUTY PER TON ON BAR IRON IMPORTED.

	From all places except Ireland. In a British ship.	From all places except Ireland. In a Foreign ship.	Imported from Ireland.
Impost, ...per ton	£1 1 $6\frac{16}{20}$	£1 10 $11\frac{5}{20}$	.. ..
Old subsidy	0 6 $7\frac{16}{20}$	0 6 $7\frac{16}{20}$	£0 6 $7\frac{16}{20}$
New subsidy	0 6 $7\frac{16}{20}$	0 6 $7\frac{16}{20}$	0 6 $7\frac{16}{20}$
$\frac{1}{3}$ and $\frac{2}{3}$ subsidy	0 6 $7\frac{16}{20}$	0 6 $7\frac{16}{20}$	0 6 $7\frac{16}{20}$
Totals.......	2 1 $6\frac{3}{20}$	2 10 $10\frac{13}{20}$	0 19 $11\frac{8}{20}$

The Inspector-General keeps in his books the quantity of goods imported from all foreign countries into England only, under the heads of "London," and the "out-ports," which is the reason he cannot distinguish what is imported into the several out-ports. He receives not accounts from Scotland, so that this is for England only.

John Oxenford, A. G.

TABLE II.

AN ACCOUNT OF THE QUANTITIES OF IRON IN BARS, PIGS, OR SOWS, IMPORTED INTO ENGLAND FROM THE PLANTATIONS.

Distinguishing each species, with the duties payable thereon, and how much the same amounted to, from Christmas, 1710, to Christmas, 1718, distinguishing each plantation and each year.*

BAR IRON.

		CHRISTMAS, 1717. Imported. T. c. q. lb.	Duty.	CHRISTMAS, 1718. Imported. T. c. q. lb.	Duty.
Barbadoes	London.	.. ..	.. ..	.. ..	.. ..
,,	Out-ports	.. ..	.. ..	0 18 1 20	£1 18 3
Nevis	London.	.. ..	.. ..	.. ..	.. ..
,,	Out-ports	0 10 0 0	£1 0 9	0 16 1 12	1 13 11
St. Christopher	London.	1 10 0 0	3 2 3	.. ..	.. ..
,,	Out-ports	.. ..	.. ..	.. ..	.. ..
Virginia	London.	.. ..	.. ..	.. ..	.. ..
Maryland	Out-ports	.. ..	.. ..	3 7 0 0	6 19 1
Totals....		2 0 0 0	4 3 0	5 1 3 4	10 11 3

DUTY ON ONE TON OF PIG IRON.

Old subsidy	£0	0	$11\frac{8}{20}$
New subsidy	0	0	$11\frac{7}{20}$
$\frac{1}{3}$ and $\frac{2}{3}$ subsidy	0	0	$11\frac{8}{20}$
Impost, 1690$\frac{2}{3}$	0	0	$11\frac{5}{20}$
Totals	£0	3	$9\frac{8}{20}$

DUTY ON ONE TON OF BAR IRON.

Impost	£1	1	$6\frac{15}{20}$
Old subsidy	0	6	$7\frac{16}{20}$
New subsidy	0	6	$7\frac{16}{20}$
$\frac{1}{3}$ and $\frac{2}{3}$ subsidy	0	6	$7\frac{16}{20}$
Total	£2	1	$6\frac{3}{20}$

JOHN OXENFORD, A. G.

TABLE III.

AN ACCOUNT OF THE QUANTITY OF STEEL IMPORTRD INTO ENGLAND, FROM CHRISTMAS, 1718, TO CHRISTMAS, 1735,

The Duty payable thereon, and what the Duties have amounted to, distinguishing each year and each country from whence imported.

	1718-1719. Imported. C. q. lb.	Duties. £ s. d.	1720. Imported. C. q. lb.	Duties. £ s. d.
E. Country	.. ..	.. ..	.. ..	.. ..
Flanders	43 3 14	20 13 9	.. ..	.. ..
Germany	6 2 0	3 1 3	19 1 7	9 1 0
Holland	2212 2 12	1043 7 8	2719 1 14	1282 7 1
Ireland	.. ..	.. ..	.. ..	.. ..
Sweden	.. ..	.. ..	9 1 0	4 6 3
Venice	20 1 27	9 13 3	12 1 7	5 16 1
Totals	2283 1 25	1076 15 11	2760 1 0	1301 10 5

* The returns were ordered from 1710, but no iron was imported previous to 1717.

TABLE III. (*continued.*)

	1721. Imported. C. q. lb.	1721. Duties. £ s. d.	1722. Imported. C. q. lb.	1722. Duties. £ s. d.
E. Country	.. ..	.. ..	.. ..	.. ..
Flanders	.. ..	.. ..	.. ..	.. ..
Germany	36 0 24	17 1 7	34 1 4	16 3 5
Holland	2912 1 12	1373 7 2	1963 1 13	925 17 0
Ireland	.. ..	.. ..	7 0 2	3 6 2
Sweden	2 2 0	1 3 7	.. ..	.. ..
Venice	.. ..	.. ..	.. ..	.. ..
Totals	2951 0 8	1391 12 4	2004 2 19	945 6 7

	1723. Imported.	1723. Duties.	1724. Imported.	1724. Duties.
E. Country	.. ..	.. ..	.. ..	.. ..
Flanders	.. ..	.. ..	.. ..	.. ..
Germany	.. ..	.. ..	10 3 3	5 1 7
Holland	2526 3 17	1191 11 10	2412 2 13	1137 14 0
Ireland	.. ..	.. ..	0 1 0	0 2 4
Sweden	37 3 3	17 16 3	.. ..	.. ..
Venice	.. ..	.. ..	.. ..	.. ..
Totals	2564 2 20	1209 8 1	2423 2 16	1142 17 11

	1725. Imported.	1725. Duties.	1726. Imported.	1726. Duties.
E. Country	.. ..	.. ..	.. ..	.. ..
Flanders	.. ..	.. ..	.. ..	.. ..
Germany	17 2 17	8 6 6	8 3 0	4 2 7
Holland	2909 0 0	1371 17 0	2925 0 7	1379 7 0
Ireland	.. ..	.. ..	.. ..	.. ..
Sweden	47 1 0	22 3 4	.. ..	.. ..
Venice	.. ..	.. ..	.. ..	.. ..
Totals	2973 3 17	1402 6 10	2933 3 7	1383 9 7

	1727. Imported.	1727. Duties.	1728. Imported.	1728. Duties.
E. Country	26 0 7	12 5 9	3 3 21	1 17 1
Flanders	58 0 0	27 7 0	.. ..	.. ..
Germany	19 1 0	9 1 7	34 1 16	16 4 4
Holland	2620 3 16	1235 18 3	2132 1 16	1005 11 1
Ireland	.. ..	.. ..	.. ..	.. ..
Spain	.. ..	.. ..	60 0 22	28 8 8
Sweden	4 2 0	2 2 5	5 0 0	2 7 2
Venice	.. ..	.. ..	.. ..	.. ..
Totals	2728 2 23	1286 15 0	2235 3 19	1054 8 4

	1729. Imported.	1729. Duties.	1730. Imported.	1730. Duties.
E. Country	.. ..	.. ..	.. ..	.. ..
Flanders	.. ..	.. ..	.. ..	.. ..
Germany	5 0 0	2 7 2	.. ..	.. ..
Holland	1879 0 19	886 2 10	3264 0 9	1539 4 5
Spain	.. ..	.. ..	1 1 16	0 13 0
Sweden	1 0 0	0 9 5	4 0 0	1 17 8
Venice	.. ..	.. ..	5 1 19	2 11 1
Totals	1885 0 19	888 19 5	3274 3 16	1544 6 2

TABLE III. (*continued.*)

	1731. Imported. C.	q.	lb.	Duties. £	s.	d.	1732. Imported. C.	q.	lb.	Duties. £	s.	d.
Denmark & Norway	4	2	24	2	4	8	..		..	..		..
E. Country	20	0	0	9	8	7	..		..	..		..
Flanders	..		..	..		..	..		..	..		..
Germany	1	3	4	0	16	9	5	3	19	2	15	9
Holland..........	2312	2	17	1090	11	11	2364	1	10	1114	18	5
Italy	..		..	..		..	20	0	0	9	8	7
Spain............	..		..	..		..	..		..	..		..
Sweden	410	0	0	193	6	9	..		..	..		..
Venice	..		..	..		..	25	1	4	12	0	1
Totals	2749	0	17	1296	8	8	2415	2	5	1139	2	10

	1733. C.	q.	lb.	£	s.	d.	1734. C.	q.	lb.	£	s.	d.
Denmark & Norway	..		..	..		..	..		..	..		..
E. Country	..		..	..		..	..		..	..		..
Flanders	..		..	..		..	..		..	..		..
Germany	35	1	11	16	13	4	..		..	..		..
Holland..........	2236	2	10	1054	13	9	4154	3	25	1959	6	10
Italy	..		..	..		..	..		..	..		..
Spain............	..		..	..		..	..		..	..		..
Sweden	..		..	..		..	1	3	21	0	18	3
Venice	..		..	..		..	..		..	..		..
Totals	2271	3	21	1071	7	1	4156	3	18	1960	5	1

	1735. Imported. C.	q.	lb.	Duties. £	s.	d.
Denmark & Norway	2	1	14	1	1	4
E. Country........	60	0	0	28	5	10
Flanders	0	1	21	0	4	1
Germany	4	1	20	2	1	9
Holland..........	2645	1	10	1247	8	9
Italy	..		..	..		..
Spain............	..		..	..		..
Sweden	19	2	15	9	5	1
Venice	..		..	..		..
Total	2732	0	24	1288	6	10

DUTIES ON ONE CWT OF STEEL.

	£	s.	d.
Old subsidy	£0	1	$5\frac{2}{20}$
New subsidy	0	1	$5\frac{2}{20}$
$\frac{1}{3}$ and $\frac{2}{3}$ subsidy	0	1	$5\frac{2}{20}$
Impost, 1690	0	5	$1\frac{17}{20}$
Total	£0	9	$5\frac{3}{20}$

Note.—The accounts for the out-ports not being yet returned to the Inspector-General for the year 1736, is the reason this account ends at Christmas, 1735. He also receives no account from Scotland, so that this account is for England only.

JOHN OXENFORD, A. G.

Custom House, London, March 28, 1737.

TABLE IV.

AN ACCOUNT OF THE QUANTITY OF IRON IN BARS, PIGS, OR SOWS, IMPORTED INTO ENGLAND FROM CHRISTMAS, 1728,* TO CHRISTMAS, 1735, FROM THE PLANTATIONS.

Distinguishing each species, with the Duties payable thereon, and how much the same amounted to, and distinguishing each Plantation and year.

BAR-IRON.

	1731.			1733.		
Countries.	London. T.c.q.lb.	Out Ports. T.c.q.lb.	Amount of Customs.	London. T.c.q.lb.	Out Ports. T.c.q.lb.	Amount of Customs.
Carolina ..	....	.. ..	.. ..	.. ..	.. ..	.. ..
Jamaica....	....	1 2 0 0	£2 14 0	.. ..	.. ..	.. ..
New York ..	....	.. ..	.. ..	0 11 3 0	.. ..	£1 4 4
Pennsylvania	....	.. ..	.. ..	.. ..	.. ..	.. ..
Virgin. Myl.	....	.. ..	.. ..	.. ..	.. ..	.. ..
Totals..		1 2 0 0	2 14 0	0 11 3 0		1 4 4
1734.				**1735.**		
Carolina ..	....	0 0 2 12	£0 1 4	.. ..	.. ..	.. ..
Jamaica....	....	.. ..	.. ..	.. ..	.. ..	.. ..
New York ..	....	.. ..	.. ..	.. ..	.. ..	.. ..
Pennsylvania	....	.. ..	.. ..	10 17 3 0	.. ..	£22 12 0
Virgin. Myl.	....	.. ..	.. ..	44 9 0 21	.. ..	92 5 7
Totals..		0 0 2 12	0 1 4	55 6 3 21		114 17 7

* No bar-iron imported in the years 1729, 1730, and 1732 inclusive.

PIG-IRON.

1728-29. Countries.	London. T. c. q. lb.	Out Ports. T. c. q. lb.	Total of both. T. c. q. lb.	Amount of Customs.
Antigua	.. ..	1 0 0 0	1 0 0 0	£0 3 9
Barbadoes	.. ..	.. ..	.. ..	.. ..
Carolina	1 1 0 0	4 0 0 0	5 1 0 0	0 19 1
Jamaica	3 0 0 0	17 14 1 18	20 14 1 18	3 18 6
Pennsylvania ..	99 13 2 0	174 12 3 21	274 6 1 21	51 19 0
St. Christopher .	2 0 0 0	.. ..	2 0 0 0	0 7 7
Virginia, Maryl.	344 9 1 24	508 6 3 15	852 16 1 11	161 10 0
W. Indies in gen.	.. ..	.. ..	.. ..	.. ..
Totals..	450 3 3 24	705 14 0 26	1155 18 0 22	218 17 11
1730.				
Antigua	.. ..	.. ..	.. ..	.. ..
Barbadoes	9 0 0 0	9 0 0 0	18 0 0 0	£3 8 3
Carolina	.. ..	10 3 1 0	10 3 1 0	1 18 6
Jamaica	9 13 1 0	5 1 1 10	14 14 2 10	2 15 9
Pennsylvania ..	105 16 0 0	83 0 0 20	188 16 0 20	35 15 1
St. Christopher .	2 9 1 21	.. ..	2 9 1 21	0 9 4
Virginia, Maryl.	779 17 3 14	746 17 2 1	1526 15 1 15	289 2 6
W. Indies in gen.	.. ..	.. ..	.. ..	.. ..
Totals..	906 16 2 7	854 2 1 3	1760 18 3 10	333 9 5

TABLE IV. (*continued.*)

1730-1731.

	London.				Out ports.				Total of both.				Amount of Customs.		
Countries.	T.	c.	q.	lb.	T.	c.	q.	lb.	T.	c.	q.	lb.			
Antigua	..		..		..		..		..		..		..	..	
Barbadoes ..	..		..		..		..		..		..		..	..	
Carolina	..		..		..		..		..		..		..	..	
Jamaica	5	0	0	0	17	10	0	0	22	10	0	0	£4	5	3
Pennsylvania .	88	1	3	27	81	1	2	16	169	3	2	15	32	0	9
St. Christopher	5	16	3	0	..		..		5	16	3	0	1	2	1
Virgin., Maryl.	1367	15	3	7	713	6	1	20	2081	2	0	27	394	2	4
W. Ind. in gen.	5	19	1	0	..		..		5	19	1	0	1	2	7
Totals..	1472	13	3	6	811	18	0	8	2284	11	3	14	432	13	0

1731-32.

	T.	c.	q.	lb.	T.	c.	q.	lb.	T.	c.	q.	lb.			
Antigua	..		..		..		..		..		..		..	..	
Barbadoes ..	..		..		..		..		..		..		..	..	
Carolina	..		..		..		..		..		..		..	..	
Jamaica	10	0	0	0	..		..		10	0	0	0	£1	17	11
Pennsylvania .	52	11	0	26	54	0	0	17	106	11	1	15	20	3	7
St. Christopher	..		..		..		..		..		..		..	..	
Virgin. Maryl.	1504	18	1	15	721	5	0	13	2226	3	2	0	422	11	7
W. Ind. in gen.	..		..		..		..		..		..		..	..	
Totals..	1567	9	2	13	775	5	1	2	2342	14	3	15	444	13	1

1732-1733.

	T.	c.	q.	lb.	T.	c.	q.	lb.	T.	c.	q.	lb.			
Barbadoes ..	..		..		..		..		..		..		..	..	
Carolina	..		..		..		..		..		..		..	..	
Jamaica	..		..		..		..		..		..		..	..	
New England .	..		..		..		..		..		..		..	..	
Pennsylvania .	43	3	2	11	52	1	3	7	95	5	1	18	18	0	10
St. Christopher	..		..		..		..		..		..		..	..	
Virgin., Maryl.	1669	14	1	13	639	17	2	9	2309	11	3	22	437	7	6
Totals..	1712	17	3	24	691	19	1	16	2404	17	1	12	455	8	4

1733-1734.

	T.	c.	q.	lb.	T.	c.	q.	lb.	T.	c.	q.	lb.			
Barbadoes ..	..		..		6	1	2	8	6	1	2	8	£1	3	0
Carolina	7	0	0	0	..		..		7	0	0	0	1	6	6
Jamaica	..		..		..		..		..		..		..	..	
New England.	..		..		..		..		..		..		..	..	
Pennsylvania .	59	4	3	0	88	3	0	11	147	7	3	11	28	18	3
St. Christopher	..		..		..		..		..		..		..	..	
Virgin., Maryl.	1397	17	3	7	644	4	2	24	2042	2	2	3	386	14	7
Totals..	1464	2	2	7	738	9	1	15	2202	11	3	22	418	2	4

1734-1735.

	T.	c.	q.	lb.	T.	c.	q.	lb.	T.	c.	q.	lb.			
Barbadoes ..	..		..		..		..		..		..		..	..	
Carolina	3	9	0	0	..		..		3	9	0	0	£0	13	1
Jamaica	7	0	0	0	..		..		7	0	0	0	1	6	6
New England.	0	6	0	0	..		..		0	6	0	0	0	1	1
Pennsylvania .	147	14	0	1	47	17	2	21	195	11	2	22	32	0	9
St. Christopher	1	13	0	0	..		..		1	13	0	0	0	6	3
Virgin., Maryl.	1353	8	0	10	1009	0	0	7	2362	8	0	17	447	7	7
Totals..	1513	10	0	11	1056	17	3	0	2570	7	3	11	481	15	3

DUTY ON ONE TON OF PIG IRON.

Old subsidy	£0	0	11$\frac{8}{20}$
New subsidy	0	0	11$\frac{8}{20}$
$\frac{1}{3}$ and $\frac{2}{3}$ subsidy	0	0	11$\frac{8}{20}$
Impost 169$\frac{2}{3}$	0	0	11$\frac{5}{20}$
Total.....................	0	3	9$\frac{9}{20}$

DUTY ON ONE TON OF BAR IRON.

Impost	£1	1	6$\frac{15}{20}$
Old subsidy	0	6	7$\frac{16}{20}$
New subsidy	0	6	7$\frac{16}{20}$
$\frac{1}{3}$ and $\frac{2}{3}$ subsidy	0	6	7$\frac{16}{20}$
Total.....................	2	1	6$\frac{3}{20}$

Note—The Accounts for the out-ports not yet being returned to the Inspector-General for the year 1736, is the reason this ends at Christmas, 1735. The Inspector-General in his books keeps the quantity of goods imported from all foreign countries into England only under the heads of London and the out-ports, which is the reason he cannot distinguish what is imported into the several outports. He receives no accounts from Scotland, so that is for England only.

TABLE V.

AN ACCOUNT OF THE QUANTITY OF IRON IMPORTED INTO ENGLAND FROM CHRISTMAS, 1728, TO CHRISTMAS, 1735, FROM FOREIGN COUNTRIES,

With the Duties thereon payable, and how much the same amounted to, distinguishing each country and each year.

FROM CHRISTMAS, 1728, TO CHRISTMAS, 1729.

	London.				Out Ports.				Total of both.				Amount of Customs.		
	T.	*c.*	*q.*	*lb.*	*T.*	*h.*	*q.*	*lb.*	*T.*	*h.*	*q.*	*lb.*			
Denm. & Nor.	270	8	2	20	92	0	1	18	362	9	0	10	£784	15	11
East Country .	26	3	2	21	50	6	1	9	76	10	0	2	158	16	3
Flanders	..		..		10	0	1	26	10	0	1	26	20	16	1
Germany	28	6	0	0	62	18	3	24	91	4	3	24	189	18	6
Holland	72	11	3	18	634	18	3	22	707	10	3	12	1468	11	11
Ireland	..		..		35	7	0	25	35	7	0	25	35	4	8
Italy	..		..		..		..		..		..		..	..	
Russia	994	3	0	14	90	7	1	22	1084	10	2	8	2279	18	9
Spain	488	17	2	0	1237	1	3	19	1725	19	1	19	3525	5	8
Sweden......	8704	1	3	11	6456	10	0	21	15160	12	0	4	32439	7	1
Guernsey	..		..		..		..		..		..		..	..	
Jersey	..		..		5	18	2	1	5	18	2	1	12	6	1
Totals..	10584	12	3	0	8675	10	1	19	19260	3	0	19	40,915	0	11

TABLE V. (*continued.*)

1729-1730.

	London. T. h. q. lb.	Out Ports. T. h. q. lb.	Total of both. T. h. q. lb.	Amount of Customs.
Denm. & Nor.	397 0 1 11	193 0 2 18	590 1 0 1	£1237 6 10
East Country .	37 10 3 26	202 3 1 23	239 14 1 21	503 3 8
Flanders	.. ..	.. ..	.. ..	.. ..
Germany	26 1 0 27	197 14 2 23	223 15 3 22	464 10 9
Holland	60 1 1 12	1048 9 2 24	1108 11 0 8	2301 0 3
Ireland	.. ..	37 8 3 18	37 8 3 18	37 7 1
Italy	21 10 3 0	.. ..	21 10 3 0	44 14 1
Russia	357 14 1 3	115 2 0 6	472 16 1 9	983 8 6
Spain	529 14 1 19	908 8 1 12	1438 2 3 3	2970 14 11
Sweden......	9897 12 3 3	7743 11 3 25	17641 4 3 0	36970 1 6
Guernsey	.. ..	1 10 0 0	1 10 0 0	3 2 3
Jersey	.. ..	2 10 0 0	2 10 0 0	5 3 9
Totals..	11327 6 0 17	10449 19 3 9	21777 5 3 26	45,520 13 7

1730-1731.

	London. T. h. q. lb.	Out Ports. T. h. q. lb.	Total of both. T. h. q. lb.	Amount of Customs.
Denm. & Nor.	172 19 0 0	205 6 3 20	378 5 3 20	£780 17 7
East Country .	193 2 3 14	132 4 1 6	325 7 0 20	697 1 6
Flanders	.. ..	.. ..	.. ..	.. ..
Germany	9 2 1 0	125 7 2 1	134 9 3 1	283 7 9
Holland	60 6 3 7	248 19 0 17	309 5 3 24	646 9 0
Ireland	.. ..	42 10 3 9	42 10 3 9	42 8 7
Italy	.. ..	.. ..	.. ..	.. ..
Russia	1305 16 1 25	320 16 2 7	1626 13 0 4	3377 4 11
Spain	327 17 3 20	1223 3 0 11	1551 1 0 3	3265 8 8
Sweden......	8839 10 1 12	11244 3 3 10	20083 14 0 22	41977 0 6
Guernsey	12 9 0 0	.. ..	12 9 0 0	25 16 10
Jersey	.. ..	.. ..	.. ..	.. ..
Totals..	10921 4 2 22	13542 12 0 25	24463 16 3 19	51095 15 4

1731-1732.

	London. T. h. q. lb.	Out Ports. T. h. q. lb.	Total of both. T. h. q. lb.	Amount of Customs.
Denm. & Nor.	279 18 0 9	259 18 2 5	539 16 2 14	£1166 15 1
East Country .	182 6 3 18	148 6 0 13	330 13 0 3	698 10 0
Flanders	.. ..	.. ..	.. ..	.. ..
Germany	.. ..	165 0 3 13	165 0 3 13	342 11 4
Holland	141 15 3 8	468 16 3 22	610 12 3 2	1277 5 8
Ireland	.. ..	6 17 3 20	6 17 3 20	6 17 5
Italy	.. ..	.. ..	.. ..	.. ..
Russia	3231 19 2 25	1224 0 0 13	4455 19 3 10	9248 18 9
Spain	522 18 3 18	1272 11 3 4	1795 10 2 22	3773 13 8
Sweden......	7781 18 1 22	7593 13 0 7	15375 11 2 1	32449 17 9
Guernsey	.. ..	.. ..	.. ..	.. ..
Jersey	.. ..	3 10 1 18	3 10 1 18	7 6 0
Totals..	12140 17 3 16	11142 15 3 3	23283 13 2 19	48,971 15 8

TABLE V. (*continued.*)

1732-1733.

	London.				Out Ports.				Total of both.				Amount of Customs.		
	T.	*h.*	*q.*	*lb.*	*T.*	*h.*	*q.*	*lb.*	*T.*	*h.*	*q.*	*lb.*			
Denm. & Nor.	255	9	0	11	203	5	0	23	458	14	1	6	£979	0	0
East Country.	87	18	0	8	135	4	1	12	223	2	1	20	463	16	2
France.......	14	8	2	0	..			..	14	8	2	0	37	1	1
Germany....	222	6	3	21	67	17	1	6	290	4	0	27	602	7	6
Holland....	75	6	2	24	344	12	1	19	419	19	0	15	871	13	5
Ireland.......	..			..	26	15	1	13	26	15	1	13	26	13	11
Russia.......	2820	7	0	6	1298	11	1	4	4118	18	1	10	8549	6	4
Spain......	693	9	0	25	1166	7	0	19	1859	16	1	16	3983	12	2
Sweden....	9432	6	1	27	7405	5	2	5	16837	12	0	4	35095	3	1
Totals..	13601	12	0	10	10647	18	2	17	24249	10	2	27	50608	13	8

1733-1734.

Denm. & Nor.	210	9	3	27	231	5	2	7	441	15	2	6	£952	3	6
East Country.	186	6	3	7	25	0	0	0	211	6	3	7	448	9	10
France.......	..			..	..			..				..	..		..
Germany....	13	1	1	7	121	3	0	10	134	4	1	17	284	14	0
Holland....	54	1	0	26	387	8	2	22	441	9	3	20	922	14	2
Ireland.......	..			..	49	13	3	15	49	13	3	15	49	11	2
Russia.......	2994	14	1	8	543	2	1	25	3537	16	3	5	7354	13	9
Spain......	383	6	0	14	1583	10	2	2	1966	16	2	16	4146	3	9
Sweden......	8999	3	1	13	8906	18	3	25	17906	2	1	10	37361	5	5
Totals..	12841	3	0	18	11848	3	0	22	24689	6	1	12	51519	15	7

1734-1735.

Denm. & Nor.	220	5	0	0	38	5	2	6	258	10	2	6	£547	11	10
East Country.	97	2	3	8	69	11	1	18	166	14	0	26	346	0	3
France......	..			..	..			..	..			..	..		..
Germany....	121	11	1	0	150	14	0	24	272	5	1	24	592	5	2
Holland....	61	2	1	20	483	11	3	20	544	14	1	12	1134	5	8
Ireland......	..			..	..			..	..			..	..		..
Russia.......	1960	13	1	1	689	12	2	21	2650	5	3	22	5500	19	5
Spain......	591	6	2	27	1430	6	3	3	2071	13	2	2	4464	16	11
Sweden......	10287	1	3	11	9759	17	0	27	20046	19	0	10	42165	9	10
Totals..	13339	3	1	11	12671	19	3	7	26011	3	0	18	54751	9	1

DUTY PER TON ON BAR-IRON IMPORTED.

	From all places except Ireland. British Ship.			Foreign Ship.			Imported from Ireland.		
	£	*s.*	*d.*	£	*s.*	*d.*			
Impost............	1	1	$6\frac{15}{20}$	1	10	$11\frac{5}{20}$	..		..
Old subsidy.........	0	6	$7\frac{16}{20}$	0	6	$7\frac{16}{20}$	£0	6	$7\frac{16}{20}$
New subsidy.......	0	6	$7\frac{16}{20}$	0	6	$7\frac{16}{20}$	0	6	$7\frac{16}{20}$
$\frac{1}{3}$ and $\frac{2}{3}$ subsidy....	0	6	$7\frac{16}{20}$	0	6	$7\frac{16}{20}$	0	6	$7\frac{16}{20}$
Totals..	2	1	$6\frac{3}{20}$	2	10	$10\frac{12}{20}$	0	19	$11\frac{6}{20}$

Note.—The accounts from the out-ports not being yet returned to the Inspector-General for the year 1736, is the reason this account ends at Christmas, 1735. The Inspector-General keeps the quantity in his books of goods imported from all foreign countries into England only under the heads of London and the Out-ports, which is the reason he cannot distinguish what is imported into the several out-ports.

Custom House, London, March 24, 1736. JOHN OXENFORD, A. G.

TABLE VI.

AN ACCOUNT OF THE QUANTITY OF IRON IMPORTED FOR TEN YEARS LAST FROM THE BRITISH COLONIES IN AMERICA,

Distinguishing each year, and the quantity imported from each Colony, and distinguishing how much in Pig and how much in Bar.

	1739.* Pig-iron.	1740. Bar-iron.	1740. Pig-iron.
	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.
Barbadoes	.. ..	.. ..	7 10 0 0
Carolina	1 9 2 27	.. ..	2 0 0 0
Jamaica	8 8 3 21	.. ..	.. ..
New England	3 18 1 0	0 4 1 21	94 0 1 12
New York	.. ..	.. ..	.. ..
Pennsylvania	170 5 3 19	.. ..	159 4 2 22
St. Christopher	.. ..	.. ..	0 10 0 0
Virginia, Maryland	2242 2 2 14	5 0 0 0	2020 2 0 22
Totals	2426 5 1 25	5 4 1 21	2283 7 1 0

	1741. Bar-iron.	1741. Pig-iron.	1742.* Pig-iron.
	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.
Barbadoes	.. ..	2 0 0 14	18 2 3 0
Carolina	.. ..	.. ..	.. ..
Jamaica	.. ..	.. ..	.. ..
New England	.. ..	42 16 1 16	5 0 0 0
New York	.. ..	.. ..	.. ..
Pennsylvania	.. ..	153 4 1 25	143 16 3 18
St. Christopher	.. ..	.. ..	.. ..
Virginia, Maryland	5 0 0 0	3261 8 1 5	1926 3 1 5
Totals	5 0 0 0	3459 9 1 4	2093 2 3 23

	1743.* Pig-iron.	1744. Bar-iron.	1744. Pig-iron.
	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.
Barbadoes	18 19 0 16	.. ..	.. ..
Carolina	.. ..	.. ..	20 1 0 19
Jamaica	.. ..	.. ..	16 0 0 0
New England	25 11 1 17	.. ..	.. ..
New York	81 4 2 7	.. ..	5 16 0 0
Pennsylvania	62 12 0 25	.. ..	87 15 0 0
St. Christopher	.. ..	.. ..	.. ..
Virginia, Maryland	2816 1 1 15	57 0 0 0	1748 4 1 3
Totals	3004 8 2 24	57 0 0 0	1877 16 1 22

* No bar-iron imported in the years 1739, 1742, and 1743.

TABLE VI. (*continued.*)

1745.	Bar-iron. T. c. q. lb.	Pig-iron. T. c. q. lb.	1746. Bar-iron. T. c. q. lb.	Pig-iron. T. c. q. lb.
Barbadoes ..	.. ..	.. ..	.. ..	.. ..
Carolina	.. ..	25 9 3 0	.. ..	.. ..
Jamaica	.. ..	.. ..	.. ..	.. ..
New England.	.. ..	2 0 0 0	.. ..	.. ..
New York ..	.. ..	18 12 0 0	.. ..	29 0 0 0
Pennsylvania .	.. ..	97 7 1 7	3 9 1 0	103 1 3 11
St. Christopher	.. ..	.. ..	.. ..	.. ..
Virgin.,Maryl.	4 5 2 14	2130 16 1 10	193 8 3 12	1729 1 0 2
Totals..	4 5 2 14	2274 5 1 17	196 18 0 12	1861 2 3 13

1747.	Bar-iron. T. c. q. lb.	Pig-iron. T. c. q. lb.	1748.* Pig-iron. T. c. q. lb.
Barbadoes	.. ..	8 1 1 8	.. ..
Carolina	.. ..	.. ..	1 4 1 21
Jamaica	.. ..	.. ..	6 0 0 0
New England	.. ..	.. ..	.. ..
New York	.. ..	13 0 0 0	22 9 1 20
Pennsylvania	.. ..	24 14 3 20	114 10 0 0
St. Christopher	.. ..	.. ..	.. ..
Virginia, Maryland........	82 11 2 11	2119 0 3 24	2017 11 3 10
Totals..	82 11 2 11	2164 17 0 24	2161 15 2 23

TOTALS BROUGHT TOGETHER.

Years.	Bar-iron. T. c. q. lb.	Pig-iron. T. c. q. lb.
1739	.. ..	2426 5 1 25
1740	5 4 1 21	2283 7 1 0
1741	5 0 0 0	3459 9 1 4
1742	.. ..	2093 2 3 23
1743	.. ..	3004 8 2 24
1744	57 0 0 0	1877 16 1 22
1745	4 5 2 14	2274 5 1 17
1746	196 18 0 12	1861 2 3 13
1747	82 11 2 11	2164 17 0 24
1748	4 0 0 0	2161 15 2 23
Totals..	354 19 3 2	23606 11 1 7

Custom House, London, Feb. 1, 1749.

* Only four tons of bar-iron imported in 1748.

TABLE VII.

AN ACCOUNT OF THE QUANTITY OF IRON IMPORTED INTO THAT PART OF GREAT BRITAIN CALLED SCOTLAND, FOR TEN YEARS LAST PAST, ENDING AT MICHAELMAS, 1749, FROM THE BRITISH COLONIES IN AMERICA,

Distinguishing each year, and the quantity imported from each Colony, and how much in Pig and how much in Bar.

Periods.	Pennsylvania. Pig-iron. T. c. q. lb.	Pennsylvania. Bar-iron. T. c. q. lb.	Virginia.* Pig-iron. T. c. q. lb.	Maryland. Pig-iron. T. c. q. lb.	Maryland. Bar-iron. T. c. q. lb.	Totals. Pig-iron. T. c. q. lb.	Totals. Bar-iron. T. c. q. lb.
Michaelmas, 1739, to ditto, 1740	11 6 2 18	....	....	....	....	11 6 2 18	—
,, 1740 ,, 1741	....	—	..:	....	....	—	—
,, 1741 ,, 1742	9 8 0 0	....	....	....	....	9 8 0 0	—
,, 1742 ,, 1743	....	....	3 7 2 12	1 12 2 18	1 16 3 18	5 0 1 2	1 16 3 18
,, 1743 ,, 1744	....	—	....	....	....	—	—
,, 1744 ,, 1745	....	....	....	27 14 3 0	....	27 14 3 0	—
,, 1745 ,, 1746	3 10 3 7	7 16 2 21	3 0 0 0	....	....	6 10 3 7	7 16 2 21
,, 1746 ,, 1747	....	1 0 0 0	6 17 3 14	....	....	6 17 3 14	1 0 0 0
,, 1747 ,, 1748	....	....	42 0 0 0	....	....	42 0 0 0	—
,, 1748 ,, 1749	....	....	10 3 3 25	144 16 0 18	....	155 0 0 15	—
Totals for the 10 years....	24 5 1 25	8 16 2 21	65 9 1 23	174 3 2 8	1 16 3 18	263 18 2 0	10 13 2 11

* No bar-iron imported from Virginia during these ten years.

Custom-house, Edinburgh, Feb. 15, 1749-50.

TABLE VIII.

AN ACCOUNT OF THE QUANTITY OF IRON IMPORTED INTO ENGLAND FROM FOREIGN COUNTRIES, FROM CHRISTMAS, 1749, TO 5TH JANUARY, 1756.

With the Duties payable thereon, and how much the same amounted to, distinguishing each country and each year.

	1749 to 1750.							1751.						
	Quantities.				Duties.			Quantities.				Duties.		
	T.	*c.*	*q.*	*lb.*	£	*s.*	*d.*	*T.*	*c.*	*q.*	*lb.*	£	*s.*	*d.*
Denm. & Norw.	415	5	0	0	1063	17	10	461	18	1	14	1229	6	2
E. Country....	636	12	3	19	1544	5	2	1040	8	3	0	2521	14	2
Germany	111	15	0	14	271	1	7	278	10	1	5	675	11	6
Holland.......	149	7	1	14	362	6	4	146	8	2	26	356	0	2
Ireland	30	4	3	22	40	15	2	26	10	2	4	35	14	11
Italy	5	7	0	0	15	9	9	26	0	0	0	63	1	4
Russia	14976	0	0	4	36326	3	2	5632	6	3	10	13664	8	10
Spain	1143	9	1	0	2780	1	6	991	7	0	18	2412	5	10
Sweden	17575	2	0	12	43519	9	10	17859	6	1	18	44093	17	2
Guernsey	....				....			....				....		
Jersey.........	....				....			....				....		
Totals ..	35,043	3	3	1	85,923	10	4	26,462	17	0	11	65,052	0	1

	1752.							1753.						
Denm. & Norw.	556	17	1	27	1451	15	4	291	17	2	23	729	4	5
E. Country....	175	11	2	4	425	17	8	132	15	1	0	322	1	9
Germany	115	18	0	0	281	2	8	257	1	2	1	726	6	7
Holland	50	15	1	7	123	2	9	202	3	3	7	491	15	11
Ireland	148	0	0	0	199	8	7	14	12	3	7	19	14	7
Italy	....				....			—				—		
Russia	8599	8	0	23	20858	19	1	7285	12	0	13	17672	2	11
Spain	1262	16	0	16	3063	1	0	347	17	1	19	839	12	3
Sweden	13935	0	1	10	34424	2	11	20044	8	1	6	49173	8	8
Guernsey	16	6	2	0	39	11	7	—				—		
Jersey.........	4	2	0	15	9	19	3	....				....		
Totals..	24,864	15	2	18	60,877	0	10	23,576	8	3	20	69,974	7	1

	1754.							1755.						
Denm. & Norw.	178	5	0	10	460	4	2	141	1	0	21	365	0	3
E. Country....	186	5	0	15	457	1	8	54	14	3	9	134	17	0
Germany	167	9	0	0	406	3	5	80	0	3	16	194	3	2
Holland	214	8	3	26	522	17	8	86	15	3	15	211	8	1
Ireland	....				....			....				....		
Italy	....				....			....				....		
Russia	6610	18	0	25	16050	11	10	9949	9	3	3	24133	14	7
Spain	1024	1	1	14	2541	19	5	967	5	3	25	2374	16	10
Sweden	22424	10	2	2	54856	13	3	17762	3	0	20	43638	13	7
Guernsey	....				....			....				....		
Jersey.........	....				....			17	1	0	0	49	17	0
Totals..	30,805	18	1	8	75,295	11	5	29,058	12	2	25	71,102	10	6

Note.—The Inspector-General receives no accounts from Scotland, so that this account is for England only. He likewise keeps his accounts from Christmas to Christmas, and cannot divide the several years, so as to make out this account from Midsummer to Midsummer, as required by the order; and the out-ports accounts for the year 1756 not being all returned to the Inspector-General, is the reason this account ends at Christmas, 1755, viz., the 5th January, 1756.

Custom-house, London, Feb. 18, 1757. JOHN OXENFORD, A. G.

TABLE IX.

AN ACCOUNT OF THE QUANTITY OF PIG AND BAR-IRON WHICH HAVE BEEN IMPORTED FROM THE BRITISH COLONIES IN AMERICA, FROM CHRISTMAS, 1749, TO 5TH JANUARY, 1756,

Distinguishing each year and each Colony, and how much in Pig and how much in Bar.

	1750.								1751.							
	Bar.				Pig.				Bar.				Pig.			
	T.	*c.*	*q.*	*lb.*	*T.*	*c.*	*q.*	*lb.*	*T.*	*c.*	*q.*	*lb.*	*T.*	*c.*	*q.*	*lb.*
Barbadoes	....				....				18	12	0	16	....			
Carolina.......	....				....				....				17	14	0	12
Jamaica	....				....				....				4	2	1	0
New England..	....				21	1	2	8	....				9	16	2	13
New York	....				75	12	1	4	2	0	0	0	33	0	3	22
Pennsylvania..	....				318	9	3	11	....				199	15	2	22
St. Kitt's	....				....				....				5	5	2	4
Virginia(Mary-[land)	5	17	3	0	2508	16	1	25	3	4	2	9	2950	5	3	15
Totals..	5	17	3	0	2924	0	0	20	23	16	2	25	3220	1	0	4

	1752.								1753.							
Barbadoes	....				0	5	0	8	0	12	1	8	0	6	3	26
Carolina.......	....				20	0	0	0	....				10	0	0	0
Jamaica	....				....				....				2	0	0	0
New England...	....				....				2	8	0	19	40	10	1	7
New York....	....				41	5	0	0	....				97	4	3	2
Pennsylvania..	64	16	2	5	156	8	2	26	147	13	2	1	242	15	1	0
St. Kitt's	....				2	4	2	7	....				....			
Virginia(Mary-[land)	16	10	2	21	2762	8	0	4	97	18	0	19	2347	9	2	18
Totals..	81	7	0	26	2982	11	1	17	248	12	0	19	2740	6	3	25

	1754.								1755.							
Barbadoes	....				30	0	0	0	0	0	2	0	....			
Carolina.......	....				20	0	0	0	....				14	13	0	0
Jamaica	....				....				....				....			
New England...	....				4	16	0	22	....				....			
New York	6	10	0	0	115	16	2	0	11	12	0	0	457	8	0	14
Pennsylvania..	110	9	3	24	512	19	3	12	79	5	0	20	836	6	1	0
St. Kitt's	....				....				....				....			
Virginia(Mary-[land)	153	15	1	8	2591	4	3	17	299	1	3	0	2132	15	1	22
Totals..	270	15	1	4	3274	17	1	23	389	19	1	20	3441	2	3	8

Note.—The Inspector-General keeps his accounts from Christmas to Christmas, and cannot divide the several years, so as to make out this account from Midsummer to Midsummer, as required by the order; and the out-ports account for the year 1756 not being all returned to the Inspector-General, is the reason this account ends at Christmas, 1755, viz., 5th January, 1756.

Custom-house, London, Feb. 18, 1757. JOHN OXENFORD, A. G.

TABLE X.

AN ACCOUNT OF THE QUANTITY OF IRON IMPORTED INTO THAT PART OF GREAT BRITAIN CALLED SCOTLAND, FROM FOREIGN COUNTRIES, SINCE THE 24TH JUNE, 1750,

With the Duties payable thereon, and how much the same amounted to, distinguishing each country and each year.

	24TH JUNE, 1750, TO 24TH JUNE, 1751.							TO 24TH JUNE, 1752.						
	Quantities.				Duties.			Quantities.				Duties.		
	T.	c.	q.	lb.	£	s.	d.	T.	c.	q.	lb.	£	s.	d.
Dantzic	..		..		..		..	..		..		..		..
Denmark	7	5	1	14	17	13	7½	..		..		..		..
Germany	..		..		..		..	2	12	3	21	6	8	4¾
Holland	27	1	3	6	65	14	2	152	12	1	20	370	4	0
Ireland	7	7	2	24	17	18	3½	36	14	3	18	89	2	7½
Livonia	5	13	0	0	13	14	1½	0	15	0	0	1	16	4½
Norway	110	1	2	25	270	7	4¾	182	8	2	21	477	1	7¾
Poland	15	14	1	1	38	2	3	11	10	3	7	27	19	10¼
Prussia	13	7	1	14	32	6	6¾	14	11	3	24	35	8	10¼
Russia	172	10	0	21	417	14	5¼	182	7	3	13	442	8	3½
Spain	12	0	1	3	29	1	9¼	25	10	0	0	61	17	1
Sweden	1199	5	1	9	2909	15	11¾	1412	12	2	8	3429	18	3¼
Totals	1570	7	0	5	3812	8	7¼	2021	17	0	20	4942	5	4¾

	1752, TO 1753.							TO 1754.						
Dantzic	..		..		..		..	..		..		..		..
Denmark	4	1	3	0	9	18	3	3	5	3	4	7	19	6¾
Germany	..		..		..		..	2	19	3	0	7	4	10¾
Holland	28	12	1	26	69	8	7¼	19	2	1	17	46	7	6¼
Ireland	..		..		..		..	..		..		..		..
Livonia	..		..		..		..	8	15	1	27	21	5	8¾
Norway	26	0	2	10	63	2	10	19	13	3	24	47	15	7½
Poland	6	19	1	3	16	17	10	2	8	0	7	5	18	0½
Prussia	6	13	2	5	16	3	11	1	4	0	14	2	18	8¼
Russia	189	11	3	4	459	15	10½	184	16	1	0	448	5	9¼
Spain	30	0	1	5	72	16	3¼	..		..		..		..
Sweden	1195	15	0	4	2899	10	0¼	1134	0	2	11	2756	4	4
Totals	1487	14	3	1	3607	13	7¼	1376	6	1	20	3344	0	2

	1754, TO 1755.							TO 1756.						
Dantzic	7	2	0	19	17	4	10½	..		..		..		..
Denmark	1	9	2	14	3	11	11¼	4	17	0	17	11	17	6¾
Germany	9	1	3	0	22	0	9¾	0	10	3	13	1	6	4¼
Holland	20	16	1	4	50	9	9¼	13	2	2	2	31	16	9¾
Ireland	..		..		..		..	..		..		..		..
Livonia	0	10	0	7	1	4	5	..		..		..		..
Norway	49	5	2	9	120	8	2¼	66	0	1	27	160	18	11¾
Poland	3	13	1	10	8	17	10¾	17	10	0	11	42	9	1¼
Prussia	9	18	3	17	24	1	4½	54	19	3	0	133	7	7¼
Russia	86	16	1	3	210	11	8	120	1	3	7	291	5	10¾
Spain	11	5	3	0	27	7	6½	2	7	2	0	5	15	2½
Sweden	1543	13	0	19	3746	11	4¼	1310	10	2	2	3178	18	3½
Totals	1743	12	3	18	4232	9	10	1590	0	2	23	3857	15	9¾

TABLE X. (*Continued.*)—TOTALS BROUGHT TOGETHER.

	Quantities. T.	c.	q.	lb.	Duties. £	s.	d.
Dantzic	7	2	0	19	17	4	$10\frac{1}{2}$
Denmark	20	19	2	21	51	0	$11\frac{1}{4}$
Germany	15	5	1	6	37	0	$4\frac{1}{2}$
Holland	261	7	3	19	634	0	$10\frac{1}{2}$
Ireland	44	2	2	14	107	0	11
Livonia	15	13	2	6	38	0	$7\frac{3}{4}$
Norway	453	11	0	4	1139	14	$8\frac{1}{2}$
Poland	57	15	3	11	140	4	$11\frac{3}{4}$
Prussia	100	15	2	18	244	7	0
Russia	936	4	0	20	2270	1	$11\frac{1}{4}$
Spain	81	3	3	8	196	17	$10\frac{1}{2}$
Sweden	7795	17	0	25	18920	18	3
Totals....	9789	19	0	3	23796	13	$4\frac{1}{2}$

Note.—The accounts from Orkney and Zetland not being come up, are not included in this account.

Custom-house, Edinburgh, March 22, 1757. A. CAMPBELL.

TABLE XI.

AN ACCOUNT OF THE QUANTITY OF PIG-IRON IMPORTED FROM THE BRITISH COLONIES IN AMERICA INTO THAT PART OF GREAT BRITAIN CALLED SCOTLAND, FROM THE 24TH JUNE, 1750, TO THE 24TH JUNE, 1756.

Distinguishing each year and each Colony, and how much in quantity.

Periods.	Maryland. T. c. q. lb.	New York. T. c. q. lb.	North Carolina. T. c. q. lb.	Pennsylvania. T. c. q. lb.	Philadelphia. T. c. q. lb.	Virginia. T. c. q. lb.	Totals. T. c. q. lb.
From June 24, 1750, to June 24, 1751	.. ..	.. ..	2 5 3 24	.. ..	.. ..	4 0 0 0	6 5 3 24
,, 24, 1751, ,, 24, 1752	35 0 0 0	.. ..	.. ..	.. ..	.. ..	55 0 0 0	90 0 0 0
,, 24, 1752, ,, 24, 1753	20 0 0 0	3 0 0 0	.. ..	.. ..	5 0 0 0	14 0 0 0	42 0 0 0
,, 24, 1753, ,, 24, 1754	25 0 0 0	0 17 1 14	.. ..	.. ..	.. ..	.. ..	25 17 1 14
,, 24, 1754, ,, 24, 1755	.. ..	35 0 0 0	.. ..	19 10 0 0	.. ..	.. ..	54 10 0 0
,, 24, 1755, ,, 24, 1756	.. ..	.. ..	.. ..	.. ..	.. ..	10 0 0 0	10 0 0 0
Totals....	80 0 0 0	38 17 1 14	2 5 3 24	19 10 0 0	5 0 0 0	83 0 0 0	228 13 1 10

Note.—The accounts from Orkney and Zetland not being come up, are not included in this account.

Custom-house, Edinburgh, March 22, 1757. A. CAMPBELL.

TABLE XII.

AN ACCOUNT OF THE QUANTITY OF IRON IMPORTED INTO SCOTLAND FROM ALL PLACES EXCEPT AMERICA, FROM 1760, TO 1st JANUARY, 1777,

Being as far as the same can be made up, together with the Gross and Net Produce of the Duties of the same, and distinguishing the years.

Years.	Wrought. Quantity.					Gross produce of Duties.				Net produce of Duties.		
	T.	*c.*	*q.*	*lb.*		£	*s.*	*d.*		£	*s.*	*d.*
1761 ..	2139	13	2	20	....	5190	1	4	....	5168	12	2
1762 ..	1700	5	1	20	....	4124	3	2	....	4124	3	2
1763 ..	2388	11	2	25	....	5793	12	0	....	5793	12	0
1764 ..	2606	2	1	19	....	6321	8	6	....	6229	6	3
1765 ..	2693	12	0	13	....	6533	8	8	....	6505	3	11
1766 ..	2423	5	2	15	....	5877	18	0	....	5761	4	0
1767 ..	2511	8	2	10	....	6091	15	0	....	5953	6	0
1768 ..	2921	11	2	0	....	7086	10	0	....	7086	10	0
1769 ..	3354	14	2	16	....	8135	1	0	....	8135	1	0
1770 ..	3111	2	0	14	....	7546	7	6	....	7546	7	6
1771 ..	2612	4	2	7	....	6336	6	8	....	6336	6	8
1772 ..	3276	10	2	22	....	7947	11	6	....	7947	11	6
1773 ..	2601	5	2	14	....	6309	13	0	....	6266	13	0
1774 ..	3480	9	3	22	....	8442	7	8	....	8336	4	0
1775 ..	2876	13	0	4	....	6977	12	1	....	6955	0	3
1776 ..	3038	14	2	10	....	7370	12	8	....	7370	12	8

RICHARD MENZIES, for the Inspector of Imports and Exports.

Custom-house, Edinburgh, January 22, 1778.

TABLE XIII.

AN ACCOUNT OF THE QUANTITY OF IRON IMPORTED INTO ENGLAND FROM CHRISTMAS, 1760, TO CHRISTMAS, 1776.

DISTINGUISHING THE QUANTITIES OF EACH SORT IMPORTED FROM AMERICA.

	Foreign.					America.			
	T.	*c.*	*q.*	*lb.*		*T.*	*c.*	*q.*	*lb.*
1761—Bar	42,328	9	3	5	......	39	1	0	0
Pig	....				......	2766	2	3	12
1762—Bar	32,049	5	1	21	......	122	12	2	14
Pig	....				......	1766	16	0	2
1763—Bar	37,262	8	13	6	......	310	19	3	2
Pig	....				......	2566	8	0	25
1764—Bar	42,752	1	2	3	......	1059	18	0	10
Pig	....				......	2554	8	3	21
1765—Bar	50,203	0	3	6	......	1078	15	0	16
Pig	....				......	3264	8	1	22
1766—Bar	30,684	16	0	11	......	1257	14	3	9
Pig	....				......	2887	5	1	15
1767—Bar	35,097	0	3	0	......	1325	19	0	18
Pig	....				......	3313	2	1	19
1768—Bar	42,626	7	1	25	......	1989	11	0	6
Pig	....				......	2953	0	2	14
1769—Bar	46,848	12	0	10	......	1779	13	1	23
Pig	....				......	3401	12	2	2
1770—Bar	44,221	12	2	20	......	1716	8	0	21
Pig	....				......	4232	18	1	18
1771—Bar	43,614	0	3	24	......	2222	4	3	24
Pig	....				......	5303	6	3	13

	T.	c.	q.	lb.		T.	c.	q.	lb.
1772—Bar	46,911	3	3	8	......	965	15	0	23
Pig	....				......	3724	19	2	25
1773—Bar	45,541	5	2	12	......	837	15	0	6
Pig	....				......	2937	13	0	2
1774—Bar	44,475	14	1	26	......	639	0	0	23
Pig	....				......	3451	12	2	19
1775—Bar	40,771	18	0	17	......	916	5	2	11
Pig	....				......	2996	0	2	24
1776—Bar	49,828	9	0	0	......	28	0	0	0
Pig	....				......	316	1	2	8

GROSS PRODUCE OF DUTIES* ON IRON IMPORTED.

	Foreign parts.				Net produce on iron.		
1761	£102,673	0	10	....	£95,550	6	1
1762	77,739	10	2	....	70,423	14	7
1763	90,384	14	6	....	84,085	13	7
1764	103,700	10	1	....	93,455	11	10
1765	121,173	14	11	....	109,807	16	3
1766	74,429	15	9	....	68,105	6	4
1767	85,132	5	10	....	75,361	14	3
1768	103,395	11	11	....	92,712	2	8
1769	113,637	2	11	....	101,767	9	7
1770	107,255	2	0	....	96,175	0	6
1771	105,791	6	3	....	92,929	2	3
1772	113,788	9	9	....	100,115	10	2
1773	110,466	1	3	....	102,138	3	2
1774	107,881	8	6	....	97,838	6	8
1775	98,897	7	0	....	90,123	14	8
1776	120,865	2	8	....	110,878	16	8

* Iron imported from America—duty free.

Note.—The Inspector-General is not yet supplied with the materials for the port of London, nor the proper returns for the several out-ports, to enable him to make up this account for the year 1777.

John Tomkyns, Assist. Inspec.

TABLE XIV.

AN ACCOUNT OF THE QUANTITY OF WROUGHT-IRON IN BARS EXPORTED TO THE PLANTATIONS, FROM CHRISTMAS 1710, TO CHRISTMAS, 1718,

Distinguishing each Plantation and each Year.

	1710 to 1711.							1712.						
	Iron, wrought.			Bars.				Iron, wrought.			Bars.			
	C.	q.	lb.	T.	c.	q.	lb.	C.	q.	lb.	T.	c.	q.	lb.
Antigua	960	0	14	0	2	0	0	877	2	7	0	11	0	0
Barbadoes	2330	1	20	31	10	0	16	2973	2	14	34	10	0	26
Bermudas	....			....				1	0	0	....			
Carolina	1143	0	27	....				1551	0	7	4	13	0	0
Hudson's Bay	12	0	0	0	10	0	0	....			2	2	0	0
Jamaica	2346	0	13	4	5	2	4	4240	0	8	28	18	2	10
Montserrat	209	3	0	....				153	0	18	....			
Nevis	204	3	21	0	8	0	0	238	1	7	25	0	0	0
New England	4596	2	6	200	19	3	7	5344	3	24	281	13	3	19
New York	567	0	19	10	2	1	10	639	1	7	32	3	0	0
Pennsylvania	987	2	0	12	10	2	21	540	0	20	2	0	0	0
St. Christopher	282	1	0	....				248	3	21	....			
Virginia (Maryland)..	3014	0	8	1	10	1	1	5653	2	4	5	3	2	14
W Indies (in general)	397	2	14	0	3	0	0	651	0	7	54	17	1	1
Totals........	17051	3	2	262	1	3	3	23112	3	4	471	12	2	14

TABLE XIV. (*continued.*)

	1713.							1714.						
	Iron, wrought.			Bars.				Iron, wrought.			Bars.			
	C.	q.	lb.	T.	c.	q.	lb.	C.	q.	lb.	T.	c.	q.	lb.
Antigua	1700	0	10	8	11	0	0	948	3	20	17	15	2	0
Barbadoes	4212	3	25	52	13	3	10	3676	2	15	38	19	2	7
Bermudas	....			....				1	0	0	....			
Carolina	1406	2	7	27	5	0	0	1051	1	18	8	10	0	0
Hudson's Bay	30	0	0	....				101	0	0	....			
Jamaica	3790	1	18	28	5	2	4	5088	0	21	21	8	0	0
Montserrat	240	3	7	....				15	2	0	....			
Nevis	795	1	13	1	5	0	0	627	3	0	1	1	0	0
New England	4883	0	13	211	9	0	2	4633	0	9	279	6	3	0
New York	985	2	21	49	8	2	16	1136	3	15	98	7	0	18
Pennsylvania	1040	0	9	7	4	3	26	923	2	1	24	12	0	7
St. Christopher	517	0	17	....				465	1	14	10	0	0	0
Virginia (Maryland)	2859	2	21	8	5	2	4	6597	2	12	8	5	0	0
W. Indies (in general)	1971	0	25	51	16	0	0	3150	3	7	23	13	0	0
Total	24433	0	18	446	4	2	6	28417	2	20	531	18	0	4

	1715.							1716.						
Antigua	1900	2	9	6	17	3	20	1430	2	21	0	10	0	0
Barbadoes	3897	1	0	83	3	2	12	4453	1	11	47	5	2	9
Bermudas	134	0	14	....				....			....			
Carolina	691	0	21	1	18	0	0	670	1	7	....			
Hudson's Bay	64	0	0	1	1	0	0	22	0	0	0	12	0	0
Jamaica	4500	1	14	9	9	3	11	4432	0	7	45	11	1	13
Montserrat	91	3	6	....				186	0	21	....			
Nevis	265	1	21	....				508	1	7	....			
New England	5795	2	24	372	16	1	16	5397	2	2	372	19	3	11
Now York	1379	3	0	110	19	0	20	1094	0	14	147	0	0	21
Pennsylvania	987	3	4	8	5	0	20	962	2	0	10	0	0	0
St. Christopher	330	0	12	....				794	3	21	1	10	0	0
Virginia (Maryland)	8946	3	15	16	17	0	14	7446	0	22	8	19	0	6
W. Indies (in general)	2082	0	27	10	4	0	0	1300	3	8	47	18	2	18
Totals	31067	0	27	621	12	1	1	28699	0	1	682	6	2	22

	1717.							1718.						
Antigua	1754	2	0	8	12	0	0	1147	2	9	....			
Barbadoes	3830	1	9	44	0	1	24	3534	3	17	46	16	1	4
Bermudas	145	2	0	....				29	3	0	....			
Carolina	866	1	11	4	2	0	0	969	0	21	2	0	0	0
Hudson's Bay	88	0	0	3	10	0	0	76	0	0	2	10	0	0
Jamaica	5166	3	17	46	15	0	0	4429	1	14	7	15	0	0
Montserrat	143	0	13	....				38	0	0	....			
Nevis	240	0	14	1	2	0	0	165	1	14	1	0	0	0
New England	3819	0	5	140	16	3	20	3110	1	1	154	4	0	0
New York	1145	0	5	42	14	1	23	1396	1	26	2	18	2	18
Pennsylvania	1147	0	26	8	15	2	18	887	0	2	3	10	0	18
St. Christopher	1231	2	7	....				382	2	0	0	13	3	12
Virginia (Maryland)	8728	1	27	10	0	1	8	6734	2	3	26	10	3	14
W. Indies (in general)	964	3	8	3	8	0	0	752	1	0	0	11	0	0
Totals	29271	0	2	313	16	3	9	23653	0	23	248	9	3	10

TABLE XV.

AN ACCOUNT OF WHAT WROUGHT-IRON, AND IRON IN BARS, HAVE BEEN EXPORTED TO FOREIGN PARTS.

Exclusive of the Plantations, from Christmas, 1710, to Christmas, 1718.

Years.		Iron, wrought.				Iron in Bars.			
		C.	*q.*	*lb.*		*T.*	*c.*	*q.*	*lb.*
1711	....	10,128	0	23	....	772	8	0	27
1712	....	9,214	2	19	....	1074	1	2	26
1713	....	13,453	0	7	....	2939	9	1	22
1714	....	16,749	1	16	....	2001	3	3	3
1715	....	15,330	3	3	....	1079	13	2	13
1716	....	11,980	1	9	....	5905	12	1	9
1717	....	16,167	0	8	....	989	0	3	12
1718	....	13,117	3	11	....	995	1	0	23
	Totals....	106,141	1	12		15,756	11	0	23

TABLE XVI.

AN ACCOUNT OF THE QUANTITY OF STEEL EXPORTED FROM ENGLAND, FROM CHRISTMAS, 1718, TO CHRISTMAS, 1735.

Years.		English Steel.				Foreign Steel.		
		C.	*q.*	*lb.*		*C.*	*q.*	*lb.*
1719	....	885	1	14	....	98	0	26
1720	....	1216	3	7	....	320	0	10
1721	....	504	1	21	....	202	0	22
1722	....	948	2	1	....	146	2	1
1723	....	1032	0	7	....	227	0	0
1724	....	1337	3	24	....	150	1	12
1725	....	1728	2	14	....	197	2	10
1726	....	1010	3	12	....	394	1	6
1727	....	622	2	21	....	436	2	3
1728	....	524	0	21	....	118	1	0
1729	....	586	0	7	....	117	3	0
1730	....	1214	0	0	....	335	2	7
1731	....	1513	0	24	....	605	3	11
1732	....	946	0	15	....	213	0	15
1733	....	2250	0	24	....	202	1	0
1734	....	2269	3	22	....	119	1	7
1735	....	3339	3	4	....	272	1	14
	Totals..	21,930	3	14		4157	1	4

Note.—The out-port accounts not being yet returned to the Inspector-General for the year 1736, is the reason this account ends at Christmas, 1735. He also receives no accounts from Scotland, so that this account is for England only.

JOHN OXENFORD.

Custom-house, London, March, 1737.

TABLE XVII.

AN ACCOUNT OF WHAT WROUGHT-IRON, AND IRON IN BARS, HAVE BEEN EXPORTED TO FOREIGN PARTS, EXCLUSIVE OF THE PLANTATIONS, FROM CHRISTMAS, 1728, TO CHRISTMAS, 1735,

Distinguishing London and the Out-ports, and the Places to which exported.

FROM CHRISTMAS, 1728, TO CHRISTMAS, 1729.

Countries.	Iron, wrought. London.			Out Ports.			Total.			Iron in Bars. London.				Out Ports.				Total.			
	C.	*q.*	*lb.*	*C.*	*q.*	*lb.*	*C.*	*q.*	*lb.*	*T.*	*c.*	*q.*	*lb.*	*T.*	*c.*	*q.*	*lb.*	*T.*	*c.*	*q.*	*lb.*
Africa	4364	3	0	1748	3	0	6113	2	0	138	11	2	10	541	12	2	25	680	4	1	7
Canaries	859	0	19	..		..	859	0	19	..		..		..		..		..		..	
Denmark and Norway	6	3	21	11	0	14	18	0	7	..		..		..		..		..		..	
East Country	477	3	0	295	0	0	772	3	0	..		..		..		..		..		..	
East India	1427	1	0	..		..	1427	1	0	579	19	2	12	..		..		579	19	2	12
Flanders	268	3	21	..		..	268	3	21	2	0	0	0	..		..		2	0	0	0
France	105	0	19	0	0	14	105	1	5	..		..		..		..		..		..	
Germany	1029	0	10	143	3	0	1172	3	10	..		..		..		..		..		..	
Holland	1438	3	10	208	2	21	1647	2	3	9	11	0	0	..		..		9	11	0	0
Ireland	776	0	0	1786	0	27	2562	0	27	122	9	0	19	20	0	0	0	142	9	0	19
Italy	130	0	0	..		..	130	0	0	..		..		12	17	0	21	12	17	0	21
Madeiras	331	2	14	488	1	7	819	3	21	38	0	0	17	..		..		38	0	0	17
Newfoundland	77	0	0	322	0	0	399	0	0	..		..		..		..		..		..	
Portugal	5778	1	0	75	3	8	5854	0	8	86	9	2	25	9	18	2	14	96	8	1	11
Russia	18	0	0	..		..	18	0	0	..		..		..		..		..		..	
Spain	8337	0	0	37	2	14	8374	2	14	89	10	3	11	6	12	1	21	96	3	1	4
Straits	654	0	21	..		..	654	0	21	162	9	2	0	..		..		162	9	2	0
Sweden	14	2	0	6	0	0	20	2	0	..		..		..		..		..		..	
Turkey	37	0	0	..		..	37	0	0	2	0	0	0	..		..		2	0	0	0
Venice	0	2	0	..		..	0	2	0	..		..		..		..		..		..	
Guernsey	27	1	0	116	0	7	143	1	7	..		..		..		..		..		..	
Jersey	12	0	0	65	2	0	77	2	0	..		..		..		..		..		..	
Totals..	26171	0	23	5305	0	0	31476	0	23	1231	1	2	10	591	0	3	25	1822	2	2	7

TABLE XVII. (*continued.*)

FROM CHRISTMAS, 1729, TO CHRISTMAS, 1730.

Countries.	Iron, wrought. London. C.	q.	lb.	Out Ports. C.	q.	lb.	Total. C.	q.	lb.	Iron in Bars. London. T.	c.	q.	lb.	Out Ports. T.	c.	q.	lb.	Total. T.	c.	q.	lb.
Africa	3138	0	0	2252	1	0	5390	1	0	177	12	3	22	471	5	2	27	648	18	2	21
Canaries	799	2	0	20	0	0	819	2	0	..		..		..		..		..		..	
Denmark and Norway	131	2	0	50	0	0	181	2	0	..		..		..		..		..		..	
East Country	389	3	10	90	0	0	479	3	10	..		..		..		..		..		..	
East India	1540	2	6	..		..	1540	2	6	336	0	0	0	..		..		336	0	0	0
Flanders	763	2	27	..		..	763	2	27	..		..		..		..		..		..	
France	282	1	0	..		..	282	1	0	..		..		..		..		..		..	
Germany	1118	0	26	84	0	0	1202	0	26	..		..		..		..		..		..	
Holland	1667	3	2	301	3	0	1969	2	2	4	2	3	21	1	19	2	24	6	2	2	17
Ireland	541	1	0	1524	2	8	2065	3	8	3	14	2	2	39	0	0	0	42	14	2	2
Italy	49	2	0	..		..	49	2	0	..		..		..		..		..		..	
Madeiras	313	0	7	98	0	0	411	0	7	33	5	3	3	6	3	0	0	39	8	3	3
Newfoundland	100	0	0	403	1	10	503	1	10	..		..		12	9	0	0	12	9	0	0
Portugal	4830	3	26	27	1	4	4858	1	2	60	0	3	13	48	14	0	8	108	14	3	21
Russia	49	2	10	20	0	0	69	2	10	..		..		..		..		..		..	
Spain	6539	1	0	114	0	18	6653	1	18	49	0	0	0	22	1	3	0	71	1	3	0
Straits	698	1	14	..		..	698	1	14	88	17	1	0	..		..		88	17	1	0
Sweden	12	2	0	..		..	12	2	0	..		..		..		..		..		..	
Turkey	1636	3	7	..		..	1636	3	7	..		..		..		..		..		..	
Venice	1	0	0	..		..	1	0	0	..		..		..		..		..		..	
Guernsey	23	0	0	42	2	14	65	2	14	..		..		..		..		..		..	
Jersey	27	0	0	62	0	0	89	0	0	..		..		..		..		..		..	
Totals..	24653	2	23	5089	3	26	29743	2	21	752	14	1	5	601	13	1	3	1354	7	2	8

TABLE XVII (*continued*).

FROM CHRISTMAS, 1730, TO CHRISTMAS, 1731.

Countries.	Iron, wrought. London. C. q. lb.	Out Ports. C. q. lb.	Total. C. q. lb.	*Iron in Bars. London. T. c. q. lb.	Out Ports. T. c. q. lb.	Total. T. c. q. lb.
Africa	2617 3 14	1782 0 14	4400 0 0	201 2 0 10	478 10 1 11	679 12 1 21
Canaries	448 1 2	13 0 0	461 1 2	.. ..	.. ..	.. ..
Denmark and Norway	77 3 0	10 2 0	88 1 0	.. ..	.. ..	.. ..
East Country	552 2 6	128 3 0	681 1 6	.. ..	.. ..	.. ..
East India	3485 2 24	.. ..	3485 2 24	525 0 0 0	.. ..	525 0 0 0
Flanders	601 0 7	.. ..	601 0 7	.. ..	.. ..	.. ..
France	222 2 0	6 0 0	228 2 0	.. ..	.. ..	.. ..
Germany	1250 3 27	199 2 24	1450 2 23	.. ..	.. ..	.. ..
Holland	1251 2 17	271 0 0	1522 2 17	6 0 0 0	1 10 0 0	7 10 0 0
Ireland	664 0 18	2409 3 23	3074 0 13	167 6 2 18	55 11 2 17	222 18 1 7
Italy	126 2 7	.. ..	126 2 7	.. ..	.. ..	.. ..
Madeiras	220 1 7	10 0 0	230 1 7	4 19 1 0	1 0 3 17	6 0 0 17
Newfoundland	33 0 0	518 0 0	551 0 0	0 10 0 0	.. ..	0 10 0 0
Portugal	4907 1 24	128 3 2	5036 0 26	34 6 2 24	10 0 0 0	44 6 2 24
Russia	42 3 0	5 0 0	47 3 0	.. ..	.. ..	.. ..
Spain	1797 2 0	192 2 8	1990 0 8	33 16 0 21	13 14 1 11	47 10 2 4
Straits	1317 3 21	.. ..	1317 3 21	32 1 1 10	.. ..	32 1 1 10
Sweden	12 0 7	25 0 0	37 0 7	.. ..	.. ..	.. ..
Turkey	80 0 10	.. ..	80 0 10	.. ..	.. ..	.. ..
Venice	2 2 0	.. ..	2 2 0	.. ..	.. ..	.. ..
Guernsey	64 0 0	97 0 0	161 0 0	9 0 0 0	.. ..	9 0 0 0
Jersey	39 0 0	52 0 0	91 0 0	.. ..	.. ..	.. ..
Totals..	19815 2 23	5849 1 15	25665 0 10	1014 2 0 27	560 7 1 0	1574 9 1 27

TABLE XVII. (*continued*).

FROM CHRISTMAS, 1731, TO CHRISTMAS, 1732.

Countries.	Iron, wrought. London. C.	q.	lb.	Out Ports. C.	q.	lb.	Total. C.	q.	lb.	Iron in Bars. London. T.	c.	q.	lb.	Out Ports. T.	c.	q.	lb.	Total. T.	c.	q.	lb.
Africa	1368	0	7	2392	1	3	3760	1	10	241	2	1	23	496	16	3	18	737	19	1	13
Canaries	446	0	0	..		..	446	0	0	..		..		..		..		..		..	
Denmark and Norway	39	1	0	46	3	0	86	0	0	..		..		..		..		..		..	
East Country	444	3	23	168	3	0	613	2	23	..		..		..		..		..		..	
East India	2195	2	0	..		..	2195	2	0	547	19	3	8	..		..		547	19	3	8
Flanders	766	3	7	..		..	766	3	7	..		..		..		..		..		..	
France	78	2	7	..		..	78	2	7	..		..		..		..		..		..	
Germany	1231	0	26	85	0	0	1316	0	26	..		..		..		..		..		..	
Holland	917	0	1	288	1	0	1205	1	1	10	0	0	0	..		..		10	0	0	0
Ireland	789	2	0	2388	3	21	3173	1	21	226	19	1	20	47	10	0	0	274	9	1	20
Italy	544	1	0	1	0	0	545	1	0	..		..		..		..		..		..	
Madeiras	160	0	0	85	2	2	245	2	2	2	2	2	6	1	8	0	6	3	10	2	12
Newfoundland	158	0	0	640	3	16	798	3	16	..		..		1	0	0	0	1	0	0	0
Portugal	8286	0	14	92	0	14	8378	1	0	50	0	0	0	33	13	3	26	83	13	3	26
Russia	35	0	0	25	0	0	60	0	0	..		..		..		..		..		..	
Spain	1968	0	27	68	2	0	2036	2	27	13	0	1	14	..		..		13	0	1	14
Straits	1824	1	14	..		..	1824	1	14	58	0	2	14	..		..		58	0	2	14
Sweden	13	0	0	..		..	13	0	0	..		..		..		..		..		..	
Turkey	48	0	11	..		..	48	0	11	..		..		..		..		..		..	
Venice	1	0	0	..		..	1	0	0	..		..		..		..		..		..	
Isles—Alderney	..		..	0	0	21	0	0	21	..		..		..		..		..		..	
Guernsey	81	3	0	70	0	0	151	3	0	..		..		..		..		..		..	
Jersey	15	2	0	82	0	26	97	2	26	..		..		..		..		..		..	
Totals	21412	0	25	6430	1	19	27842	2	16	1149	5	1	1	580	8	3	22	1729	14	0	23

TABLE XVII. (*continued.*)

FROM CHRISTMAS, 1732, TO CHRISTMAS, 1733.

Countries.	Iron, wrought. London. C.	q.	lb.	Out Ports. C.	q.	lb.	Total. C.	q.	lb.	Iron in Bars. London. T.	c.	q.	lb.	Out Ports. T.	c.	q.	lb.	Total. T.	c.	q.	lb.
Africa	1354	0	0	1635	3	2	2989	3	2	77	12	0	19	245	12	0	24	323	4	1	15
Canaries	116	1	14	5	0	0	121	1	14	..		..		..		..		..		..	
Denmark and Norway	36	3	0	47	2	0	84	1	0	..		..		..		..		..		..	
East Country	369	1	21	204	0	0	573	1	21	..		..		..		..		..		..	
East Indies	2151	2	0	..		..	2151	2	0	430	0	0	0	..		..		430	0	0	0
Flanders	670	1	20	..		..	670	1	20	..		..		..		..		..		..	
France	174	0	0	10	0	0	184	0	0	..		..		..		..		..		..	
Germany	1106	0	15	59	0	7	1165	0	22	..		..		..		..		..		..	
Holland	831	3	13	239	0	0	1070	3	13	..		..		..		..		..		..	
Ireland	1040	2	14	1448	3	2	2489	1	16	61	1	2	8	10	0	0	0	71	1	2	8
Italy	116	1	19	2	0	0	118	1	19	..		..		..		..		..		..	
Madeiras	324	2	0	2	0	0	326	2	0	16	10	0	0	..		..		16	10	0	0
Newfoundland	168	2	0	823	1	2	991	3	2	..		..		58	11	0	16	58	11	0	16
Portugal	8609	3	11	84	0	0	8693	3	11	71	10	0	14	4	11	3	12	76	1	3	26
Russia	48	0	0	69	0	0	117	0	0	..		..		..		..		..		..	
Spain	2623	3	21	92	2	0	2716	1	21	50	0	0	0	21	7	1	0	71	7	1	0
Straits	2272	3	14	..		..	2272	3	14	52	0	0	0	..		..		52	0	0	0
Sweden	22	1	0	1	0	0	23	1	0	..		..		..		..		..		..	
Turkey	62	1	7	..		..	62	1	7	..		..		..		..		..		..	
Venice	7	0	0	0	0	14	7	0	14	..		..		..		..		..		..	
Guernsey	39	2	0	300	3	0	340	1	0	..		..		..		..		..		..	
Jersey	26	0	0	116	2	14	142	2	14	..		..		..		..		..		..	
Totals..	22172	1	1	5140	1	13	27312	2	14	758	13	3	13	340	2	1	24	1098	16	1	9

TABLE XVII. (*continued.*)

FROM CHRISTMAS, 1733, TO CHRISTMAS, 1734.

Countries.	Iron, wrought. London. C.	q.	lb.	Out Ports. C.	q.	lb.	Total. C.	q.	lb.	Iron in Bars. London. T.	c.	q.	lb.	Out Ports. T.	c.	q.	lb.	Total. T.	c.	q.	lb.
Africa	1323	3	0	1604	1	0	2928	0	0	91	6	0	9	267	4	3	17	358	10	3	26
Canaries	358	0	0	..		..	358	0	0	..		..		..		..		..		..	
Denmark and Norway	10	2	14	28	2	22	39	1	8	..		..		..		..		..		..	
East Country	542	2	10	70	0	0	612	2	10	..		..		..		..		..		..	
East India	5413	0	26	..		..	5413	0	26	568	0	0	0	..		..		568	0	0	0
Flanders	775	3	18	..		..	775	3	18	..		..		..		..		..		..	
France	47	3	10	4	0	0	51	3	10	..		..		..		..		..		..	
Germany	1002	1	7	93	0	0	1095	1	7	..		..		..		..		..		..	
Holland	793	1	3	123	0	0	916	1	3	..		..		..		..		..		..	
Ireland	515	2	0	1597	1	12	2112	3	12	617	11	2	19	16	9	3	0	634	1	1	19
Italy	98	2	0	..		..	98	2	0	..		..		..		..		..		..	
Madeiras	208	0	0	9	0	0	217	0	0	10	6	3	27	8	8	3	6	18	15	3	5
Newfoundland	24	0	0	362	0	0	386	0	0	..		..		0	5	1	7	0	5	1	7
Portugal	5622	1	7	198	0	0	5820	1	7	84	10	2	7	30	16	3	24	115	7	2	3
Russia	23	0	0	28	0	0	51	0	0	..		..		..		..		..		..	
Spain	3066	3	7	1	0	0	3067	3	7	12	16	3	4	..		..		12	16	3	4
Straits	1307	2	21	..		..	1307	2	21	31	9	2	0	..		..		31	9	2	0
Sweden	23	0	0	..		..	23	0	0	..		..		..		..		..		..	
Turkey	4	0	14	..		..	4	0	14	..		..		..		..		..		..	
Venice	2	0	0	..		..	2	0	0	..		..		..		..		..		..	
Alderney	..		..	1	0	0	1	0	0	..		..		..		..		..		..	
Guernsey	46	2	0	52	2	2	99	0	2	..		..		..		..		..		..	
Jersey	183	0	0	109	3	0	292	3	0	..		..		..		..		..		..	
Totals..	21391	3	25	4281	2	8	25673	2	5	1416	1	2	10	323	5	2	26	1739	7	1	8

TABLE XVII. (*continued.*)

FROM CHRISTMAS, 1734, TO CHRISTMAS, 1735.

Country.	Iron, wrought. London. H. q. lb.	Iron, wrought. Out Ports. H. q. lb.	Iron, wrought. Total. H. q. lb.	Iron in Bars. London. T. h. q. lb.	Iron in Bars. Out Ports. T. h. q. lb.	Iron in Bars. Total. T. h. q. lb.
Africa	1220 3 22	1914 1 25	3135 1 19	70 19 1 11	321 19 2 13	392 18 3 24
Canaries	818 0 0	.. ..	818 0 0	.. ..	.. ..	.. ..
Denmark and Norway	45 1 0	33 3 14	79 0 14	.. ..	.. ..	.. ..
East Country	379 3 7	381 0 0	760 3 7	.. ..	.. ..	.. ..
East India	7948 0 0	.. ..	7948 0 0	417 19 1 0	.. ..	417 19 1 0
Flanders	627 2 6	.. ..	627 2 6	.. ..	.. ..	.. ..
France	106 2 0	5 0 0	111 2 0	.. ..	1 0 0 0	1 0 0 0
Germany	1453 1 4	99 1 0	1552 2 4	.. ..	.. ..	.. ..
Holland	872 0 24	155 2 0	1027 2 24	.. ..	.. ..	.. ..
Ireland	1375 2 2	2137 0 26	3512 3 0	404 17 2 17	21 12 1 21	426 10 0 10
Italy	382 0 7	.. ..	382 0 7	.. ..	.. ..	.. ..
Madeiras	836 2 14	27 0 0	863 2 14	6 0 0 0	49 2 1 5	55 2 1 5
Newfoundland	75 0 0	514 2 20	589 2 20	.. ..	0 3 0 0	0 3 0 0
Portugal	6481 0 17	181 1 21	6662 2 10	200 18 0 8	22 8 3 7	223 6 3 15
Russia	39 2 7	14 0 0	53 2 7	.. ..	.. ..	.. ..
Spain	2939 1 18	18 0 0	2957 1 18	50 4 0 24	.. ..	50 4 0 24
Straits	2060 1 14	.. ..	2060 1 14	204 19 3 0	.. ..	204 19 3 0
Sweden	4 1 0	.. ..	4 1 0	.. ..	.. ..	.. ..
Turkey	69 3 25	.. ..	69 3 25	.. ..	.. ..	.. ..
Venice	8 2 0	.. ..	8 2 0	.. ..	.. ..	.. ..
Guernsey	59 0 0	52 1 22	111 1 22	.. ..	2 6 0 0	2 6 0 0
Jersey	73 0 0	104 3 0	177 3 0	.. ..	.. ..	.. ..
Totals..	27875 3 27	5638 2 16	33514 2 15	1355 18 1 4	418 12 0 18	1774 10 1 22

Note.—The out-ports' accounts not being yet returned to the Inspector General for the year 1736, is the reason this account ends at Christmas, 1735. The Inspector General, in his books, keeps the quantities of goods exported to all foreign countries from England, only under the heads of London and the out-ports, which is the reason he cannot distinguish what is exported from the several out-ports.

Custom-house, March 24, 1736.

John Oxenford, A. G.

TABLE XVIII.

AN ACCOUNT OF THE QUANTITY OF WROUGHT-IRON, AND IRON IN BARS, EXPORTED TO THE PLANTATIONS, FROM CHRISTMAS, 1728, TO CHRISTMAS, 1735, DISTINGUISHING EACH PLANTATION AND EACH YEAR.

	1729.							1730.						
	Iron, wrought.			Bars.				Iron, wrought.			Bars.			
	H.	*q.*	*lb.*	*T.*	*c.*	*q.*	*lb.*	*H.*	*q.*	*lb.*	*T.*	*c.*	*q.*	*lb.*
Antigua............	2170	0	25	3	10	0	0	1496	3	12	2	1	3	0
Barbadoes..........	2854	1	21	24	17	1	1	3585	3	22	27	18	0	0
Bermudas	269	1	14		....			20	0	0		....		
Carolina	1342	1	21	3	10	0	0	1479	3	23	5	10	0	0
Georgia............	....				....			....				....		
Hudson's Bay	94	2	0	2	12	0	0	170	0	0	2	0	0	0
Jamaica	8742	0	14	19	18	2	4	6322	0	8	17	7	0	0
Mountserrat	213	2	4		....			199	0	0		....		
Nevis..............	570	1	5	1	0	0	0	246	3	26	0	6	0	0
New England	7393	3	0	337	12	2	23	7329	2	24	149	13	1	5
New Providence	....				....			....				....		
New York..........	1903	2	23	58	0	0	25	2775	0	0	91	10	2	13
Pennsylvania	851	0	14	4	0	0	0	2628	3	20	0	0	2	3
St. Christopher's	1673	1	15	1	10	3	0	1733	3	11		....		
Virginia (Maryland)	4866	0	23	1	1	0	0	6389	2	24	2	9	0	7
W. Indies (in general)	2394	0	3	27	9	2	0	2507	3	2	137	11	1	18
Totals	35339	0	14	485	1	3	25	36865	3	4	436	7	2	18

	1731.							1732.						
Antigua............	1543	2	19		....			827	2	2	18	0	0	0
Barbadoes..........	3140	0	0	28	2	1	14	2470	3	8	13	7	3	6
Bermudas	38	0	0	1	0	0	0	22	0	0		....		
Carolina	1770	0	11	10	18	1	7	2167	3	7	9	0	0	0
Georgia............	....				....			271	0	0		—		
Hudson's Bay	112	0	0	1	5	0	0	142	2	0	2	1	0	0
Jamaica	5320	2	26	26	14	0	0	5582	1	8	9	9	0	0
Mountserrat	35	1	14		....			51	3	0		—		
Nevis..............	84	0	7		....			167	2	0		—		
New England	9727	1	7	243	8	2	7	8597	2	4	413	5	2	17
New Providence	3	0	0		....			—				—		
New York	2627	2	7	101	11	1	1	2380	0	24	58	5	3	27
Pennsylvania	2946	0	7	5	0	0	0	2207	2	26	2	16	0	21
St. Christopher's	1084	2	0	0	10	0	0	776	2	21	2	11	0	0
Virginia (Maryland)	9681	3	11	3	18	0	0	7445	3	27	4	14	0	0
W. Indies (in general)	2192	2	21	36	2	1	0	3085	1	24	11	11	2	4
Totals	40306	3	18	458	9	3	1	36196	3	11	545	2	0	19

TABLE XVIII. (*continued*).

	1733. Iron, wrought. C. q. lb.	1733. Bars. T. c. q. lb.	1734. Iron, wrought. C. q. lb.	1734. Bars. T. c. q. lb.
Antigua	1080 2 21	1 0 0 0	1401 2 18	1 0 0 0
Barbadoes	2625 1 5	2 4 0 0	1298 2 13	10 10 1 0
Bermudas	.. ..	.. ..	207 0 0	.. ..
Carolina	2692 3 11	25 0 0 0	2880 2 19	7 15 3 21
Georgia	332 1 0	.. ..	41 0 14	1 0 0 0
Hudson's Bay	159 0 0	4 2 0 0	122 0 0	2 12 0 0
Jamaica	5545 0 0	17 19 0 0	4840 0 5	26 0 0 0
Mountserrat	217 0 7	.. ..	169 1 14	.. ..
Nevis	166 1 0	.. ..	127 1 0	.. ..
New England	7104 3 14	370 14 2 7	6191 3 5	263 8 3 0
New Providence	3 0 0	.. ..	.. ..	.. ..
New York	1609 3 7	55 0 0 0	2291 0 6	90 6 3 20
Pennsylvania	2419 2 8	2 0 0 0	3149 2 21	.. ..
St. Christopher's	1470 1 21	.. ..	544 1 0	.. ..
Virginia (Maryland)	8815 1 10	12 0 0 0	8641 0 7	1 15 3 2
W. Indies (in general)	1995 2 13	7 10 1 0	3683 2 0	5 14 2 0
Total	36237 0 5	497 9 3 7	35589 0 10	410 4 0 15

	1735. Iron, wrought. C. q. lb.	1735. Bars. T. c. q. lb.
Antigua	1721 0 10	1 7 0 0
Barbadoes	1795 0 16	.. ..
Bermudas	.. ..	.. ..
Carolina	3353 1 23	5 19 0 14
Georgia	1700 0 0	4 0 0 0
Hudson's Bay	74 0 0	1 15 0 0
Jamaica	6247 2 1	3 13 0 0
Mountserrat	473 1 14	.. ..
Nevis	150 3 0	.. ..
New England	6543 2 23	101 9 3 0
New Providence	14 0 0	.. ..
New York	2136 2 7	108 8 1 5
Pennsylvania	2102 0 0	.. ..
St. Christopher's	840 2 7	0 12 0 0
Virginia (Maryland)	9709 1 24	2 13 0 0
W. Indies (in general)	4960 2 15	3 7 0 0
	41822 1 0	233 4 0 19

Note.—The out-ports' accounts not being yet returned to the Inspector General, is the reason this account ends at Christmas, 1735.

Custom-house, London, March 24, 1736. JOHN OXENFORD, A. G.

TABLE XIX.

AN ACCOUNT OF BAR-IRON EXPORTED TO THE BRITISH PLANTATIONS, FROM CHRISTMAS, 1746, TO CHRISTMAS, 1749, DISTINGUISHING EACH YEAR.

		T. c. q. lb.
From Christmas, 1746, to Christmas	1747	26 13 2 6
	1748	57 4 1 17
	1749	159 18 2 23
	Total	243 16 2 18

Custom-house, London, March 8, 1749. JOHN OXENFORD, A. G.

NOTES TO CHAPTER V.

AMONGST other curious calculations, in the year 1783, iron is estimated in what we imported and made from its rough state, through all its various manufactured branches, to be of the value of 8,700,000*l.*—the greatest part of which may be reckoned labour; indeed, it is astonishing to see this branch extended to so great an extent in so short a period, not so much in the rough material as the hardware manufactures at Birmingham, and other places, but particularly at Sheffield, so famous for cutlery. The first knives made in England were by one Thomas Mathews, of London, in the year 1563, when we imported the greatest part of our manufacture requisite from Flanders and other countries.—*Oddy's European Commerce.*

1785.—The manufactures in iron and steel being objects of great importance, the exportation of any of the tools or engines used in them, or of models or plans of such, was prohibited, under the penalty of one year's imprisonment, and a fine of 200*l.*, besides forfeiture of the articles shipped, or proved to have been intended to be shipped. The same fine was also inflicted upon the commander of any vessel knowingly receiving such articles on board, and on custom-house officers permitting them to be shipped; such officers, and also commanders of the king's ships so offending, being, moreover, rendered for ever incapable of holding any office under his Majesty; but the exportation of the artificers themselves is more strictly prohibited. Any person enticing or endeavouring to seduce any one who has wrought in the iron or steel manufacture to go to a foreign country, is liable to one year's imprisonment, and a penalty of 500*l.* for every person he has enticed, or endeavoured to entice; and in case of committing the offence a second time, the imprisonment and fine are to be doubled. Nothing in this Act, however, prevents workmen from removing to Ireland; or tools, &c., from being shipped for that kingdom (25 Geo. III. c. 67). This Act was amended the next year, making it lawful to export from Great Britain to the British

West Indies, or to any part whatever, any tools or utensils made use of in the iron or steel manufactures of this kingdom, which might have been legally exported before the passing of 25 Geo. III. c. 67, except "rollers, either plain, grooved, or of any other form or denomination of cast iron, wrought iron or steel, for the rolling of iron, or any sort of metals, and frames, beds, pillars, screws, pinions, and each implement, tool, or utensil thereunto belonging; rollers, slitters, frames, beds, pillars, and screws for slitting mills; presses of all sorts in iron, steel, or other metals, which are used with a screw exceeding one inch and a half in diameter, or any parts of such articles, or any model of any such utensils, engines, or machines, or any part thereof; and all sorts of utensils, engines, or machines, used in the casting or boring cannon, or any sort of artillery, or any parts thereof, or any model tools, utensils, engines, or machines used in casting or boring of cannon, or any sort of artillery, or parts thereof." It was afterwards confirmed by 30 Geo. III. c. 18, s. 12, and made perpetual 35 Geo. III. c. 38, s. 4.

1788.—It is worthy of observation, that orders were sent from Paris to Mr. Wilkinson (a gentleman of great eminence in the iron manufacture) for iron pipes, to the extent of no less than forty miles, to be used in supplying that capital with water.—*Macpherson's Annals of Commerce.*

AN ACCOUNT OF THE QUANTITY OF BAR-IRON IMPORTED INTO GREAT BRITAIN, DISTINGUISHING FROM WHAT PLACES IMPORTED INTO ENGLAND, AND ONLY THE TOTAL QUANTITY INTO SCOTLAND.

[From " Oddy's European Commerce."]

YRS.	DENMARK.	RUSSIA.	SWEDEN.	GERMANY.	SPAIN.	OTHER COUN.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1786	1218	26,029	16,834	..	50	197
1787	1636	21,829	18,492	18	146	283
1788	1337	27,816	16,877	413	244	174
1789	798	25,005	19,903	675	69	58
1790	175	22,440	20,466	573	104	51
1791	1100	29,971	19,572	220	76	622
1792	705	26,892	24,442	20	273	119
1793	961	33,511	20,079	..	45	180
1794	408	21,170	15,816	..	64	119
1795	172	26,215	18,171	32	..	239
1796	962	29,083	18,006	3	..	220
1797	464	20,537	11,428	425	..	279
1798	302	29,446	15,799	272	..	142
1799	264	23,451	18,623	12	..	97

YEARS.	ENGLAND.	SCOTLAND.	TOTAL.
	Tons.	Tons.	Tons.
1786	44,330	4235	48,565
1787	42,407	4321	46,728
1788	46,836	4633	51,469
1789	46,511	4532	51,043
1790	43,812	5428	49,340
1791	51,564	5609	57,173
1792	52,453	5240	57,693
1793	54,780	4182	58,962
1794	37,578	4901	42,479
1795	44,830	4696	49,526
1796	48,276	5001	53,277
1797	33,135	3825	36,960
1798	45,964	5964	51,928
1799	42,479	5852	48,331

May, 1790—COKE FURNACES IN GREAT BRITAIN.

CUMBERLAND.

NAMES.	SITUATION. Miles from	PROPRIETORS.	OCCUPIERS.	NO.	BT.	BLT.
Seaton	1 Workington	Christian, Esq.	Spedding & Co.	1	W	1760

LANCASHIRE.

Hay	2 Wiggan	Lord Balcarras	Lindsey & Co.	1	E	1789

YORKSHIRE.

Masborough	1 Rotherham	Earl Effingham	Walker & Co.	2	E	1765
Chappel Town.	6 Sheffield	.. ..	Swallow	2	E	1778
Seacroft	4 Leeds	.. ..	.. ..	1	W	1780
Park	2 Sheffield	Duke of Norfolk	Booth & Co.	1	W	1786
Barking Shaw	2 Halifax	.. ..	Emmett	1	W	1780

DERBYSHIRE.

Wingerworth	2 Chesterfield	Sir H. Hurlsake	Butler	2	E	1780
Chesterfield	½ Ditto	J. Shimmell	Smith & Co.	2	E	1777
Stone Gravel	1 Ditto	.. ..	Barnett & Co.	2	E	1780
Athersley	10 Derby	Hurt	Hurt	1	..	1782
Stayley	4 Chesterfield	Mather	Mather	1	..	..
Dale Abbey	7 Derby	Earl Stanhope	English	1	E	1790

STAFFORDSHIRE.

Bradley	4 Whampton	J. Wilkinson	J. Wilkinson	2	E	1758
Tipton	1 Dudley	Lord Dudley	Parkers	2	E	1782
Ettingshall	3 Whampton	Messrs. Buckley	Gibbons's	1	E	1789
Deepfield	4 Ditto	Penn & Co.	Penn & Co.	1	E	1788
Wednesbury	4 Ditto	S. Hallen	S. Hallen	1	E	1785
Level	3 Stourbridge	Lord Dudley	Gibbons's	1	E	1787
Apedale	3 Newcastle	Sir N. Gresley	Parkers	1	E	1768
Brierly	2 Stourbridge	Bancks & Co.	Bancks & Co.	1	E	1790
	Newcastle	Sir J. Heathcote	Kinnersley & Co.	1	E	1790

MONMOUTHSHIRE.

Blaenavon	6 Abergavenny.	Earl Abergavenny	T. Hill & Co.	3	E	1790
Beaufort	9 Ditto	Duke of Beaufort	Kendalls	1	W	1780
Ebury	9 Ditto	J. Miles	Watkins & Co.	1	E	1790
Sirhowy	10 Ditto	Sir Johns	Atkinson	1	W	1778
Blaendair	1 Pontypool	D. Tanner	D. Tanner	1	E	1790

SHROPSHIRE.

Ketley	2 Wellington	Lord Stafford	Reynolds & Co.	4	E	1758
Horse Hay	4 Ditto	M'Slaney	Ditto	1	E	1758
Dunnington	3 Ditto	Three Lords	Ditto	1	E	1786

SHROPSHIRE—(*continued*).

NAMES.	SITUATION. Miles from	PROPRIETORS.	OCCUPIERS.	NO.	ST.	BLT.
Coalbrook Dale	2 Broseley	R. Reynolds	Dale Company	2	W	1720
Madeley Wood	1 Ditto....	Ditto	Ditto	2	E	1757
Lightmoor	5 Wellington ..	Lord Craven	Homfrays	2	E	1758
Snedshill	2 Ditto....	Lord Jerningham	J. Wilkinson ..	2	E	1778
Hollingswood..	2 Ditto....	Ditto........	Ditto......	2	E	1787
Willey	1 Broseley	G. Forrester	Ditto......	1	E	1757
Calcut........	1 Ditto....	Ditto........	Brodie	1	E	1775
Barthall	1 Ditto....	Harris, Esq.	Bancks & Co..	2	E	1775
Conneyberry ..	Ditto......	Davenport, Esq..	Ditto......	1	E	1786
Cleehill	4 Cleobury ..	Lord Craven	Botfield & Co..	1	E	1778
Park	3 Wellington..	H. Browne, Esq..	Brown & Co...	2	E	1790

GLAMORGANSHIRE.

Cyfartha......	Merthyr	Lord Talbot	Crawshay & Co.	2	E	1767
Plymouth	1 Ditto....	Lord Plymouth ..	R. Hill	1	W	1766
Herwain	5 Ditto....	Lord Cardiff	Glover	1	W	1756
Dowlais	2 Ditto....	Ditto	Dowlais Co. ..	2	E	1758
Pen-y-darran..	1 Ditto....	L. Evans	S. Homfray....	1	E	1785
Mellin Court ..	4 Neath	Lord Vernon....	Myers & Co...	1	W	..
Cefn-Cripps ..	Cowbridge ..	Bedford	Green & Co...	1	W	1790

SCOTLAND.

Carron	2 Falkirk	Bruce of Kinnair	Carron Co.....	5	W	1760
Wilson Town..	6 Whitburn ..	Wilson	Wilson	2	E	1782
Clyde	3 Glasgow	E. Dunlop	Eddington Co..	2	E	1787
Cleland	12 Ditto....	Col. Dalrymple ..	Col. Dalrymple	2	E	1788
North Kirk....	12 Douglas	Mr. Strong	Greave & Co..	1	E	1788

May, 1790—CHARCOAL FURNACES.

CUMBERLAND.

Duddon	12 Ulverston ..	Mr. Copeland ..	Latham & Co..	1	..	1750

WESTMORELAND.

Leighton	2 Milnthorp ..	Lord Derby	Halton Co.....	1	..	1715

LANCASHIRE.

Halton	2 Lancaster ..	Bradshaw	Halton Co.....	1	..	1756
Backborough ..	10 Ulverston ..	J. Mitchell	Backborough Co.	1	..	1705
Newlands	1 Ditto....	Exrs. G. Nott....	Exrs. G. Nott..	1	..	1750

YORKSHIRE.

NAMES.	SITUATION. Miles from	PROPRIETORS.	OCCUPIERS.	NO.	BT.	BLT.
Masborough	1 Rotherham	Lord Effingham	Walkers	1	..	1740
Hague	5 Leeds	Sir W. Blackett	Cook & Co.	1	..	..
SHROPSHIRE.						
Brinswood	4 Ludlow	R. Knight, Esq.	Downing & Co.	1	..	..
Bowden	Cleobury	Sir W. Blount	Sir W. Blount	1	..	..
GLOUCESTERSHIRE.						
Lidney	Near Lidney	Bathers, Esq.	D. Harford	1	..	..
Bishop's Wood	6 Ross	Lord Foley	W. Partridge	1	..	..
Flaxley	Newnham	Crawley, Esq.	Crawley, Esq.	1	..	..
Redbrook	3 Monmouth	Lord Gage	Partridge & Co.	1	..	..
MONMOUTHSHIRE.						
Tintern Abbey	5 Chepstow	Duke of Beaufort	D. Tanner	1	..	..
Pont-y-pool	1 Pont-y-pool	Hanbury, Esq.	Ditto	1	..	..
Llanethly	5 Abergavenny.	Ditto	Ditto	1	..	..
GLAMORGANSHIRE.						
Pen-y-tyrck	8 Cardiff	Lord Talbot	Lewis	1	..	..
Caerphilly	7 Ditto	J. Morgan	Harford & Co.	1	..	..
Pen-y-skedwin.	6 Swansea	T. Aubery	Parsons	1	..	..
CARMARTHENSHIRE.						
Carmarthen	.. ..	J. Morgan	J. Morgan	1	..	..
MERIONETHSHIRE.						
Aberdovey	.. ..	L. Edwards	Kendalls	1	..	..
SCOTLAND.						
Bunnawe	Nr. Inverary	Duke of Argyle	Exrs. G. Nott	1	..	..
Argyle	Ditto	Ditto	Kendalls	1	..	..
SUSSEX.						
Ashburnham	3 Battle	Lord Ashburnham	Ditto	1	..	..
Heathfield	Near ditto	J. Fuller	J. Fuller	1	..	..

APPENDIX C.*

COMPARATIVE VIEW OF THE ESTIMATES OF THE

Estimate of the Net Produce of the Duty upon Iron, as transmitted to the Deputies of the Iron Trade, by the Right Hon. N. Vansittart.

Gross produce of the tax, as stated by the iron masters	£500,000
Duty on iron imported on an average of the last six years—	
Pig and cast, 1,967 tons, at 2*l.* .. .. Other iron 36,226 ,, at 3*l.*	112,612
	£612,612

Deduct iron consumed by the Ordnance, on an average of the last two years—

Foreign iron, 859 tons, at 3*l.*	£2,567			
Native cast, 10,790 tons, at 2*l.*	21,580			
Ditto bar, 1,942 tons, at 3*l.*	5,826			
		29,973		

NAVY.

Foreign, 964 tons, at 3*l.*	£2,892			
British, 307 tons, at 3*l.*..	921			
Ditto ballast, on average of two last years, 3,837 tons, at 2*l.*	7, 674			
		11,487		
Suppose for victualling and other services not included—say..	£10,000	—10,000		
			51,460	
Drawback on Foreign iron exported, 4,590 tons, at 3*l.*		£13,770		
Ditto on British iron exported, (*See* Statement of Drawbacks, No. 1)		123,138		
			136,908	
			188,368	
Expense of officers—say			5,000	
				193,368
Total				£419,244

From which is to be deducted in the two first years, the war duty suspended, amounting to about 50,000*l.*, but which will be more than compensated by the duty on the stock in hand.

* Page 99.

NET PROCEEDS OF THE DUTY ON PIG-IRON.

Contra Statement of the Net Produce of the Duty upon Iron, estimated by the Deputies of the Iron Trade.

Duty on the pig-iron made in Great Britain in the year 1805, 250,000 tons, at 2*l*.		£500,000 0
Ditto on foreign bar-iron imported in 1805, 27,173 tons, at 4*l*.		108,692 0
Ditto on pig-iron imported in 1805, 915 tons, at 2*l*.		1,830 0
Ditto on nails ditto ditto, 15 tons, at 6*l*.		90 0
DEDUCT.		£610,612 0
Ordnance Board used, in 1805, as per government documents—		
Foreign bar-iron, unwrought, 460 tons, at 4*l*.	£1,840 0	
Ditto ditto, wrought, 612 tons, at 5*l*. 10s.	3,366 0	
Native iron, unwrought, 137 tons, at 5*l*.	685 0	
Ditto ditto, wrought, 1,407 tons, at 6*l*. 10s.	9,145 10	
Ditto ditto, cast-iron, 16,043 tons, at 3*l*. 10s.	56,150 10	
	71,187 0	
Deduct old stores sold from government account, at three-fourths of the duty paid on them	8,117 10	
		63,069 10
Navy Board purchased in 1805—		
Foreign iron, 1,025 tons, at 4*l*.	4,100 0	
English ditto, 770 tons, at 5*l*.	3,850 0	
Ballast ditto, 5,220 tons, at 2*l*. 10s.	13,067 0	
Besides the iron used in the King's yards they are supplied, by contract, with anchors, mooring-chains, cabouses, bolts, spades, shovels, tools of all kinds, crows, pole-axes, augers, saws, locks, hinges, chains, hooks, screws, ladles, frying-pans, hammers, spikes, ship-hearths, &c., supposed to be at least 2,000 tons, at 5*l*. 10s.	11,000 0	
		32,017 0
The Victualling-office—		
Hoops, nails, &c., 1,200 tons, at 5*l*. 7s. 6d.		6,450 0
Increased charge of muskets—say 150,000—furnished last year, at 1s. each		7,500 0
Iron work of the artillery and ammunition waggons and carts, which are furnished by contract, amounting to 50,000*l*. annually, which will be increased at least 10 per cent.		5,000 0
Nails, iron work for barracks and depôts, accoutrements for cavalry, intrenching and camp equipage—suppose		3,000 0
Shoes for cavalry horses, 30,000, at 4s. 6d. each		6,750 0
		£123,786 10
Drawbacks on British iron, and iron wares exported, calculated on the basis proposed by Mr. Vansittart, (*See* Statement of Drawbacks, No. 2.)		200,104 0
Ditto on foreign iron exported, 4,200 tons, at 4*l*.		16,800 0
Expense of collecting the duty, supposed 5 per cent. on the gross produce of the duty on British iron		25,000 0
		£365,690 10
		*£244,921, 10
As per Statement of Drawback, No. 3.	266,804	
Exceeding the drawback above stated of	200,104	66,700 0
Net produce of the tax		£178,221 10

* This sum of 244,921*l*., is made out upon the supposition of a drawback being

Explanatory Remarks on the Statement transmitted by the Hon. N. Vansittart, and that prepared by the Deputies of the Iron Trade.

1. The quantity of pig-iron made in Great Britain is supposed to have been doubled since the year 1796. The duty is estimated on the produce of the last year, 1805; but the duty on foreign iron is taken on an average of the importation for six years, being more than the importation of 1805 by 9000 tons. Had the produce of the tax been likewise estimated on the average quantity of native iron made in six years, the amount would have been 80,000*l.* less than is now assumed. The Treasury statement is estimated, not only on the whole quantity made in 1805, but also on 9000 tons of foreign iron, for which native iron has been substituted.

2. The duty of 2*l.* per ton, proposed to be charged on foreign iron, will not protect the British iron master; as bar-iron, of that quality, must, in consequence of the duty, be raised from 4*l.* to 5*l.* per ton. Nor will the merchant importer sell his iron to government, with the exact advance which he has paid in the form of duty, as this statement presumes; still less will the maker of British iron wares be able to supply government with them, at an advance only equal to four-fifths of the duty paid on the raw material employed in their manufacture. Instead of an advance of 2*l.* per ton on cast wares, and 3*l.* per ton on bar-iron, he must, to indemnify himself, charge an advance of 3*l.* 10*s.* on the former, and 4*l.* to 5*l.* on the latter.

3. By reference to the account prepared by the iron masters, as stated above, it will appear how much the average consumption of the Ordnance department, assumed in the Treasury estimate, differs from the amount used last year; and the same may be said of the averages stated for the Navy department. All these items should certainly have been taken for the same year, upon which the produce of the furnaces has been calculated.

4. The sum set down in the Treasury estimate for services, not

allowed only on the amount of the raw materials employed in the manufacture of the different articles. To give a proper indemnification to the export merchant, for the advance consequent upon this tax, he must be allowed a drawback, not only upon the raw material consumed in his wares, but also upon the expenses incurred by and profits charged on the duty in the successive stages of the manufactory; and the amount of such drawback, even supposing the stamps upon the debentures to be allowed by government.

included, is so small, that the deputies of the iron trade conceive that some very material error must have occurred in making out the amount.

5. The allowance of the war tax for two years is not included in the statement made above by the deputies of the iron trade. If the tax alluded to is a temporary one, it may cease to operate at the moment when encouragement is most wanted, and when their competitors can take their iron wares to every independent market. At all events, it appears to be matter of indifference to the result of this calculation, from what source the compensation to the exporter is derived. The amount of it must, in any case, be considered as a deduction from the proceeds of the tax. If the war tax is relinquished, other supplies must be had to an equal amount, and such a mode of compensation would have a partial operation, from the difference in the duty, as it respects Europe and America.

6. It is presumed that the expense of collecting this duty will not be less than that of any other important excise duty. The average expense of collection, management, and other incidental charges of the whole of the excise duties, has been stated, by Sir John Sinclair, at 5½ per cent., but, allowing for improvements in the system, the iron masters have only assumed 5 per cent.

COMPARATIVE VIEW OF DIFFERENT ESTIMATES OF THE DRAWBACK UPON THE EXPORTS OF IRON WARES.

No. I. Computation of the proposed Drawback on British Iron exported; transmitted to the Deputies of the Iron Trade, by the Right Hon. N. Vansittart, Secretary to the Treasury.				Remarks on the Statement of Drawbacks, transmitted by the Right Hon. Nicholas Vansittart.
				As the amount of the duty is estimated on the quantity of pig-iron made in the year 1805, it is proper that the drawback should also be calculated on the exports of that year, and not upon an average of years when less pig-iron was made, the produce being proportioned to the vent.
	Tons.	Tons.	£	
Pig-iron	1,665			
Cast..................	2,357			
		4,022, at 2*l.*	8,044	The pig and cast-iron are taken in the Treasury statement, upon an average of ten years. The drawback proposed on cast wares exported is the same as that on the pig-iron from which those cast wares are made, without allowance for waste, although one ton of cast-iron wares for exportation uses 25 cwt. of pig-iron.
Bar		3,382, at 3*l.*	10,146	The bar-iron is also taken upon an average of ten years, but an average is quite inapplicable to this article, as the export is rapidly increasing, owing to the large demand from Ireland. In the year 1796, the first year of the average, it was only 407 tons 10 cwt., and, in 1805, the last year of the average, it amounted to no less than 6594 tons. The demand occasioned by this exportation, of course, induced a larger produce to which the duty attaches. The drawback is taken too low, for it requires 35 cwt. of pig-iron, on an average, to make one ton of bars.
Nails	1,550			
Wrought-iron and hardware	20,487			
		22,037, at 4*l.*	88,148	The government statement of the export of nails shows that our trade in them is much decreased. They and the hardwares are both taken upon an average of ten years. The drawback is calculated upon the tax paid by two tons of pig-iron, which are consumed in making one ton of nails; but is much too low for the hardwares, one ton of which is supposed, on an average, to consume three tons of pig-iron.
Tin plates		2,100, at 4*l.*	8,400	This quantity is calculated on an average of ten years. The pig-iron consumed in making one ton of tin plates, is two tons and a half; but, as it has been by some estimated lower, the deputies call it two tons and a quarter.
Ordnance and small arms, suppose equal to tin plates............		2,100, at 4*l.*	8,400	It is not easy to discern any connexion, or ground of comparison, between tin plates and ordnance; the average value of ordnance being supposed 16*l.*, and of tin plates 62*l.* per ton. The amount of the exports of ordnance and small arms, upon the Treasury average of ten years, is 245,306*l.* The separate amount of ordnance and small arms is not stated; but supposing only one-half to have been ordnance, at 16*l.* per ton, the weight of it alone would have been 7665 tons.
		Total....	£123,138	

COMPARATIVE VIEW OF DIFFERENT ESTIMATES, &c.—*continued.*

No. II.

Computation of a Drawback on Iron and Iron Wares exported in the year 1805, supposing the Drawback only to be allowed on the quantity of Raw Material consumed in the manufacture of the article.*

Article	Tons. £ s.	£	£	Difference between the two computations. £
Pig-iron	3,276 at 2 0—	6,552		
Cast-iron wares, using 25 cwt. of pig-iron per ton	1,983 at 2 10—	4,957	11,509	3,465
Bar-iron, supposed to include rod-iron, using at least 35 cwt. of pig-iron per ton	6,594 at 3 10	..	23,079	12,933
Nails	725 at 4 0—	2,900		
Hardwares, using 3 tons of pig-iron per ton of wares	20,685 at 6 0—	124,110	127,010	38,862
Tin plates, using 2¼ tons of pig-iron per ton	3,000 at 4 10	..	13,500	5,100
Ordnance & small arms—the value exported last year is 198,566*l.*				
Suppose one-half is ordnance, value 99,283*l.*, at 16*l.* per ton, 6205 tons, using 27½ cwt. per ton ..	at 2 15—	17,063		
Small arms, supposed value 99,283*l.*, at 8 per cent.	.. ..	7,943	25,006	16,606
Totals			£200,104	£76,966

No. III.

Computation of a Drawback on Iron and Iron Wares which would indemnify the Export Merchant for the duty and the advances necessarily charged upon it in the successive stages of the manufacture, supposing the stamps and debentures to be allowed by government.

Article	Tons. £ s. d.	£	£	Difference between the two estimates of Drawbacks. £
Pig-iron ..	3,276 at 2 7 6—	7,780		
Cast-iron wares .	1,983 at 3 10 0—	6,940	14,720	6,676
Bar and rod-iron	6,594 at 5 0 0	..	32,970	22,824
Nails	725 at 6 0 0—	4,350		
Hardwares ..	20,685 at 8 0 0—	165,480	169,830	81,682
Tin plates ..	3,000 at 6 10 0	..	19,500	11,100
Ordnance and small arms—these cannot be accurately computed for want of the weights, but it is supposed the advance on both will be at least 15 per cent. on the value, 198,566*l.* ..			29,784	21,384
Total			£266,804	
Deficiency in the Right Hon. N. Vansittart's estimate of the drawback, compared with one which would indemnify the exporter.				143,666

* This statement was prepared upon the above basis, at the suggestion of the Right Hon. Nicholas Vansittart, but is by no means considered by the deputies of the iron trade as an adequate drawback, as it contains no allowance for additional expenses incurred, and profit upon the increased capital in the various stages of the manufacture subsequent to that in which the tax is imposed.

CHAPTER VII.

SPAIN.

By a law recently passed, pig-iron is allowed to be imported on the following terms :—

Government duty :—

If in Spanish ships, 6 rials*	}	per Spanish cwt. about
Foreign...... 8 „	}	22 to a ton.

Port charges 2 rials; say, therefore, 10 rials per 100 lbs., being at the rate of about 2*l*. per ton.

A work is established at Malaga, called the Constantia Iron Company, who are importing considerable quantities of metal from this country.

* About ninety-six rials to a pound sterling.

CHAPTER X.

FRANCE.

The following tables are taken from the " Résumé des Travaux Statistiques de l'Administration des Mines, en 1839."

Note.—With reference to the " Méthodes Catalane et Corse" in the following table, it may be remarked, that the difference between the Corsican and the Catalonian methods consists in the latter roasting the ore at a distinct operation, and employing a second one in the reduction, agglutination, and refining of the metal.

TABLEAU DU NOMBRE ET DE LA CONSISTANCE DES USINES A FER DE FRANCE, EN 1838.

Désignation des Groupes d'usines à Fer et des départements faisant partie de chaque groupe.	Fabrication de la Fonte. Hauts Fourneaux marchant.										Fabrication du Gros Fer. Travail au Charbon de Bois.								Travail mixte au charbon de bois et à la houille.			Travail à la houille.					Fabrication de l'Acier de Forge.			Nombre total des fonderies de minerai et des forges.
	Au charbon de bois seul.		Au bois cru ou partiellement carbonisé, seul ou mélangé de charbon de bois.		Alternativement au charbon de bois seul et au coke seul.		Au charbon de bois et au coke mélangés.		Au coke seul.		Méthodes catalane et corse. [*See* NOTE, p. 308.]		Méthode comtoise.	Méthode bergamasque.	Méthode wallonne.		Méthode nivernaise.		Méthode comtoise modifiée.			Méthode champenoise.		Méthode Anglaise.			Avec un seul foyer.	Avec deux foyers.		
	A l'air froid.	A l'air chaud.	A l'air froid.	A l'air chaud.	A l'air froid.	A l'air chaud.	A l'air froid.	A l'air chaud.	A l'air froid.	A l'air chaud.	Foyers catalans.	Foyers corses.	Foyers d'affinerie.	Foyers bergamasques.	Foyers d'affinerie.	Foyers de chaufferie au charbon de bois.	Foyers de mazerie.	Foyers d'affinerie.	Foyers d'affinerie.	Foyers de chaufferie à la houille.	Fours à réverbère de chaufferie.	Fours à Puddler.	Foyers de chaufferie.	Fineries.	Fours à Puddler.	Fours à réverbère de chaufferie.	Foyers d'affinerie.	Foyers de mazerie.	Foyers d'affinerie.	
1. Groupe de l'Est	48	4	1	23	..	..	..	..	..	..	..	..	253	..	..	..	..	..	..	..	..	3	2	..	5	3	..	6	5	151
2. — du Nord-ouest	60	..	..	..	..	..	..	..	..	..	..	..	2	..	81	40	..	..	7	1	3	..	..	3	6	4	..	..	..	60
3. — de l'Indre	19	1	..	..	..	..	..	..	..	..	..	..	70	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	23
4. — du Périgord ..	68	..	..	..	..	..	..	..	..	..	3	..	185	..	..	..	..	..	4	..	1	1	2	..	5	2	11	..	..	118
5. — du Sud-est ..	6	2	2	..	..	..	..	..	..	..	..	..	3	9	..	..	..	..	..	..	..	..	..	..	..	..	29	..	..	40
6. — du Nord-est ..	39	8	13	5	..	5	..	..	..	..	..	..	163	..	..	..	..	..	..	..	..	26	23	..	26	15	4	1	1	83
7. — de Champagne et Bourgogne	135	6	..	2	..	..	..	..	..	..	..	..	127	..	..	..	..	..	..	..	..	51	57	..	28	21	..	..	..	158
8. — du Centre	48	4	..	..	1	..	5	..	4	..	..	..	121	..	..	..	31	45	7	..	4	1	1	12	40	15	..	19	37	122
9. — du Sud-ouest ..	19	..	..	1	..	..	..	..	..	..	..	..	37	..	..	..	..	..	8	..	2	..	..	..	5	2	..	..	..	22
10. — des houillères du Nord ..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	3	6	4	35	14	..	..	..	10
11. — des houillères du Sud ..	..	..	..	..	..	..	..	..	2	21	..	..	..	..	..	..	..	..	..	..	..	1	2	55	68	37	..	..	..	15
12. — des Pyrénées et de la Corse	..	..	..	..	..	..	..	..	..	..	114	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	109
Totaux....	442	25	16	31	1	5	5	..	12	21	117	8	961	9	81	40	31	45	26	1	10	86	93	74	218	113	44	26	43	911

STATISTIQUE DE L'INDUSTRIE DU FER—PRODUITS DE 1838.

FEUX ET ATELIERS.	Nombre des Feux et Ateliers. Actifs.	Nombre des Feux et Ateliers. Inactifs.	Ouvriers employes aux divers Feux et Ateliers.	Produits. NATURE.	Produits. Poids Total sans defalcation pour cause de transportation ulterieure.	Produits. VALEUR.	Produits. Valeur créée ou valeur du produit, defalcation faite de la valuer de la mattiere primiere employee.
§ 1. EXTRACTION ET PRÉPARATION DES MINERAIS.							
				MINERAI.	quint. mèt.	francs.	francs.
Exploitation { Minières	2184	261	10,273	brut (à fondre, à laver, ou à griller) (a)	23,050,081	5,429,296	5,429,296
Exploitation { Mines	144	97	3,681				
Lavage. { Lavoirs à bras	1465	566	1,751	lavé	8,072,130	9,690,810	2,139,346
Lavage. { " à cheval	41	11					
Lavage. { " à machine	303	42					
Grillage—Fours de Grillage	116	22	173	grillé	877,230	1,140,879	244,999
Transport des minerais	..	..	(b) ..		....	....	6,481,544
			15,878		....	....	14,295,185
§ 2. FABRICATION DE LA FONTE (BRUT OU MOULÉE DE 1re FUSION.) (c)							
				FONTE OBTENUE			
Fonte des Minerais. Hauts fourneaux marchant au charbon de bois suel	380	78	5,457	au charbon de bois seul. { brute	2,166,113	37,798,251	38,925,966
				{ moulée	378,957	10,846,044	
Hauts fourneaux marchant au bois (cru ou partiellement carbonisé) seul ou mélangé de charbon de bois	43	4	636	au bois (cru ou part. carbonisé) seul ou mél. de charbon de bois .. { brute	184,974	3,484,124	4,162,481
				{ moulée	53,430	1,025,859	
Hauts fourneaux marchant alternativement au charbon de bois et au coke	6	..	308	au charb. de bois et ou coke employés alternat. ... { brute	97,410	1,516,878	2,039,408
				{ moulée	25,370	749,340	
Hauts fourneaux marchant au charbon de bois et au coke mélangés	5	..	158	au charbon de bois et au coke mélangés ...... { brute	72,562	1,306,116	1,411,211
				{ moulée	12,080	350,320	
Hauts fourneaux marchant au coke seul ou mélangé de houille	22	11	432	au coke seul, ou mélangée de houille { brute	482,247	5,541,633	3,924,955
				{ moulée	4,623	115,575	
	465	93	6,991	Total des diverses sorts de fontes.	3,477,766	63,384,140	50,464,021

OBSERVATIONS.

(a) Les minières ont produit 20,820,910 q.m. valant 4,229,025fr., et les mines 2,229,171 q.m. valant 1,210,271fr.

(b) Les transports de mineraise font ordinairement pendant la belle saison, par les habitans des campagnes, dans l'intervalle des travaux agricoles. On n'a point fait de recherches sur le nombre très-considérable des ouvriers, qui se livrent à cette industrie, parceque ceux-ci ne se rattachent qu'accidentellement à l'industrie du fer.

(c) La fonte obtenue se subdivise comme il suit, eu égard au combustible employé à sa fabrication:
Fonte au combustible végétal 2,783,474 q.m.
Fonte au combustible minéral 486,870 q.m.
Fonte obtenue à l'aide du mélange ou de l'emploi alternatif des combustibles vegetal et mineral 207,422 q.m.

Affinage de la Fonte. Méthode comtoise	Foyers d'affinerie	735	226	3,805	l'affinage comtois	839,409	39,930,865	17,377,082
— wallonne	....	76	5	523	— wallon	89,675	3,869,492	1,867,852
	Feux de chaufferie	38	2					
— nivernaise	Foyers de mazéage	17	14	85	— nivernais	11,172	538,541	303,789
	— d'affinerie	25	20					
— comtoise modifiée	— —	24	2	413	— comtois modifié	47,444	2,063,228	800,130
—	— de chaufferie.	1	..					
—	Fours à rév. de chie.	10	..					
	— à puddler	67	19					
— champenoise	Foyers de chaufferie.	78	15	1,030	— champenois	279,434	10,289,798	3,995,749
— anglaise	Fineries	64	10	2,535	— anglais	828,545	29,437,474	11,033,336
	Fours à puddler	176	42					
	— à rev. de chie.	87	26					
					le traitement des riblons (e)	43,125	2,477,337	
				10,057	Total des diverses sorts de gros fer.	2,241,957	92,898,164	38,023,518

§ 4. ÉLABORATIONS PRINCIPALES DU GROS FER ET DE LA FONTE.

Etirage du fer au martinet et au laminoir	Foyers de chaufferie.	119	41	834	Petit fer	250,954	12,583,663	1,854,716
	Fours —	83	12					
Fabrication du fer de fonderie	Foyers —	20	5	956	Fer de fenderie	325,080	15,166,640	1,209,213
	Fours —	90	22					
— du fer de tirerie	Feux —	42	6	415	Fer de tirerie	110,870	6,300,050	559,451
— du fil de fer		..	..	1,382	Fil de fer	123,900	9,699,088	2,553,229
— de la tôle		..	..	821	Tôle	196,032	12,529,979	2,500,761
— de fer-blanc		..	..	342	Fer-blanc	39,340	4,530,200	1,464,545
Traitement nes riblons	Foyers de chaufferie.	43	4	333	Fer de riblons	43,125	2,477,337	898,632
	Fours —	26	..					
Fabrication de la fonte moulée de 2d fusion	— à rèverbère	66	21	3,757	Fonte moulée de deuzième fusion.	409,880	16,993,877	7,453,950
	Cubilots	271	62					
				8,840		....	....	18,494,497

§ 5. FABRICATION ET ELABORATIONS PRINCIPALES DE L'ACIER.

Fabrication de l'acier de forge	Foyers de mazéage	25	1	260	Acier de forge (f)	34,840	2,407,856	1,147,227
	— d' affinerie	76	11					
— de cémentation	Fours de cémentation	29	15	135	Acier de cémentation	30,215	1,974,761	507,554
					Total des deux sortes d'acier brut	65,055	4,382,617	1,654,781
Corroyage de l'acier	Feux de corroyage	125	25	660	Acier corroyé	35,864	4,896,110	1,473,917
Fusion de l'acier	Fours de fusion	64	..	52	Acier fondu	6,423	1,024,050	506,293
Fabrication des faux	Martinets	60	16	280	Faux	7,028	2,100,915	1,104,360
— des limes		..	..	1,089	Limes	3,155	989,839	599,512
				2,476		....	....	5,338,863

TOTAUX.

Total des ouvriers employés aux travaux spéciaux de l'industrie du fer (g)	44,242	Total des valeurs créées par l'industrie du fer	127,216,084

égard au combustible employé à sa fabrication :
Fer combustible végétal 1,043,409 q.m.
Fer au combustible minéral 1,107,979 q.m.
Fer au mélange des deux sortes de combustibles 47,444 q.m.

(e) Pour obtenir le total du fer neuf livré par les usines françaises au commerce ou aux élaborations dont il est question dans le § 4, on à reporté ici le produit des forges à riblons; mais comme ces usines ne sont qu'élaborer du vieux fer, c'est au § 4 qu'on à dû faire figurer à valeur créée par cette industrie.

(f) On a obtenu en outre dans cette fabrication 5,872 q.m. de gros fer valant 422,799fr. qui ont été compris ci-dessus dans le gros fer obtenu à l'aide des diverses méthodes § 3.

(g) A ce nombre il faut joindre un nombre au moins aussi considérable l'ouvriers employés dans les usines, à l'exploitation et à la carbonisation des bois, au transport des minerais, des combustibles et des divers produits.

STATISTIQUE DE L'INDUSTRIE MINERALE.—PRODUITS DE 1838.

Nature de l'Industrie.	Nombre des mines, minières, &c. Exploitées.	Non Exploitées.	Ouvriers employés aux mines, minières et usines.	PRODUITS. Nature.	Poids.	Valeur.	Valeur créée.
EXPLOITATION DES COMBUSTIBLES MINERAUX ET DE LA TOURBE.							
					Quint. mét.	Francs.	Francs.
Exploitation de la houille	157	64	23,751	Houille	29,446,947	29,078,083	
" du lignite	51	38	1366	Lignite	1,010,886	916,528	
" de l'anthracite	28	18	1099	Anthracite	674,692	939,189	
	236	120	26,216	Total	31,132,525	30,933,800	30,933,800
" de la tourbe	2011	488	36,958	Tourbe	3,955,530	3,482,770	3,482,770
Totaux	2247	608	63,174		35,088,055	34,416,570	34,416,570
FABRICATION ET ELABORATIONS PRINCIPALES DE LA FONTE, DU FER ET DE L'ACIER.							
Extraction et préparation du minerai de fer	2328	358	15,878	Minerai préparé	..	..	14,295,185
Fabrication de la fonte	..	..	6991	Fonte brute et moulée (1re fusion)	3,477,766	63,334,140	50,464,021
" du gros fer	..	..	10,057	Gros fer	2,221,957	92,898,164	38,623,518
Elaborations principales du fer et de la fonte	..	..	8840	Fer élab. et fonte moulée (2d fusion)	..	..	18,494,497
Fabric. et élaborat. principales de l'acier	..	..	2476	Acier brut et élaboré	..	..	5,338,863
Totaux	2328	358	44,242		..	..	127,216,084

Voyez le tableau précédent pour le résumé détaille de la production des diverses branches de l'industrie du fer.

En 1838, les quantités de matières premières extraites du sol ou portées en France pour les besoins de l'industrie du fer ont été les ivantes :*

			QUINT. MET.
Minerai brut fourni par les mines et minières françaises . . .			23,050,081
Minerai importé de l'Ile d'Elbe et de Suisse			9,646
Fonte brute importée d'Angleterre, de Belgique, d'Allemagne, de Toscane, de Prusse, de Sardaigne, &c. . . .			162,793
importé	(Fabriqué au charbon de bois et un marteau) de Suède, de Russie, d'Espagne, d'Autriche, et de Norwège .	52,773	57,144
	(Fabriqué à la houille et au laminoir) d'Angleterre, d'Espagne d'Allemagne, de Sardaigne, de Prusse, etc.	4,371	
Acier brut importé de Prusse, d'Angleterre, d'Autriche, d'Allemagne, de Hollande, de Suisse, de Suède, etc. . . .			8,821
Riblons ou ferrailles d'Angleterre, et des Pays-Bas, etc. . . .			9,917

* Résumé des Travaux Statistiques de l'Administration des Mines, en 1839.

CHAPTER XI.

UNITED STATES OF AMERICA.

APPENDIX D.*

STATEMENT A.

The committee of manufactures of iron, appointed by the Convention, assembled at Philadelphia, to examine the returns received in answer to the circulars addressed to different individuals engaged in that branch of industry, report the following tabular statement as the result of their investigations:—

States.	1828.			1829.			1830.		
	Furnaces.	Pig-iron.	Castings.	Furnaces.	Pig-iron.	Castings.	Furnaces.	Pig-iron.	Castings.
	No.	Tons.	Tons.	No.	Tons.	Tons.	No.	Tons.	Tons.
Pennsylvania .	44	24822	3693	44	27425	4564	45	31056	5506
New Jersey ..	11	1733	6264	11	1941	5998	10	1671	5615
Maryland....	5	2247	483	5	1715	1065	6	3163	1259
Virginia	2	400	50	2	702	72	2	538	43
Ohio.........	..	..	..	..	..	..	7	5400	250
Delaware	1	450	350	1	450	350	1	450	350
Missouri	..	..	..	..	..	..	2	590	250
	63	29652	10840	63	32233	12049	73	42868	13273

One furnace, erected in Pennsylvania in 1830, will, in 1831, make 1100 tons of pig-iron.

In addition to the seventy-three furnaces mentioned in the preceding Table, from which detailed returns had been received, the committee had information of 129 furnaces, in the States of Pennsylvania, New York, Vermont, Massachusetts, Connecticut, Tennessee, New Hampshire, Virginia, and Ohio, in actual operation, but from them had then received no returns. Taking the production of the seventy-three furnaces, from which returns have been received, as the rate for estimating the whole, and the following would be the result:—

Years.	Furnaces.	Pig-iron.	Castings.	Total.
	No.	Tons.	Tons.	Tons.
1828	192	90,368	33,036	123,404
1829	192	98,234	36,720	134,954
1830	202	118,620	36,728	155,348

But as the greater part of the furnaces, not included in the returns, are situated in districts where but few castings are made,

* Page 235.

the committee have not felt authorised to estimate the quantity of castings made at them at more than about 5 per cent. of their entire production, which would give the following proportions and results :—

Years.	Furnaces. No.	Pig-iron. Tons.	Castings. Tons.	Total. Tons.
1828	192	108,564	14,840	123,404
1829	192	118,405	16,549	134,954
1830	202	137,075	18,273	155,348

From the best information the committee have been able to collect on this subject, they estimate, that of the pig-iron made in these years, about 10,000 tons per annum, have, upon an average, been converted in the air furnaces and cupolas into castings, leaving to be manufactured into bar-iron—

In 1828,	of pig-iron,	98,564 tons,	making of bars	70,403 tons.
1829	„	108,405	„	77,432 „
1830	„	127,075	„	90,768 „

And which quantities severally correspond with remarkable proportional accuracy with the returns from 132 forges, which accompanied the returns from the seventy-three furnaces first mentioned.

In East Jersey—in a part of Connecticut—in a large district of New York, and in Vermont, bar-iron is extensively made by the process technically denominated "blooming"—or by a single operation from the ore, without the intervention of the blast-furnace.

The returns already received justify the committee in putting down this description of bar-iron, for the year 1828, at 5341 tons; 1829, 5654 ditto; 1830, 5853 ditto; of which 2197 tons in East Jersey—making a total of bar-iron for 1828, of 75,744 tons; 1829, 83,086 ditto; 1830, 96,621 ditto; and the entire quantity of iron, in its first stage, as shown in the following Table :—

Description of iron.	1828. Tons.	1829. Tons.	1830. Tons.
Pig-iron	108,564	118,405	137,075
Castings from blast-furnaces	14,840	16,549	18,273
Bloomed bar-iron, for the years respectively, reduced to pig-iron, at 28 cwt. to the ton of bars	7,477	7,916	8,194
Total iron in pigs and castings	130,881	142,870	163,542

Total increase of all kinds of iron in two years very nearly 25 per cent.

For the purpose of determining the value of the above iron, the

committee have taken the average prices of the principal sea-ports, and those of Pittsburgh and Cincinnati, and have estimated that two-thirds of the bar-iron made in the United States is sold in the western markets. The proportion may be greater, which would increase the entire value.

In 1828 the average price of American hammered iron in the principal cities east of the Susquehannah was 105 dollars, and at Pittsburgh and Cincinnati 125 dollars; the average estimated as above would be 118⅓. In 1829 the prices were 100 and 122—giving an average of 114⅔; and in 1830, 90 and 100 dollars—average 96⅔. Castings from the blast furnaces are valued at sixty dollars, although many sell higher; and from the air furnace and cupola at 4½ cents per lb., which is certainly not above the average rate.

At these prices the aggregate value of the iron made in—

1828	would be	10,861,440 dollars.
1829	„	11,528,134 „
1830	„	11,444,410 „

Increase in market value in two years less than 5½ per cent.—decrease in value from 1829 to 1830 nearly three-fourths of 1 per cent.

APPENDIX E.*

STATEMENT B.

Prices of iron in England, taken from the invoices of the importers in New York :—

Years.	Flat.	Rounds.					Square.		
	Com'on size.	Com'on size.	5-8.	1-2.	3-8.	1-4.	Com'on size.	1-2.	
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1806	20 6 0	22 6 0	23 6 0	27 0 0	..	..	19 6 0	..	..
1808	..	14 5 0	15 5 0	..	..	..	..	..	..
1809	14 0 0	15 0 0	16 0 0	..	..	..	14 0 0	17 0 0	..
1810	13 0 0	14 0 0	..	17 0 0	..	..	13 0 0	16 0 0	..
1815	11 0 6	11 0 0	11 0 0	16 0 0	..	..	11 0 0	13 0 0	..
1816	10 0 0	10 0 0	10 0 0	..	..	..	10 0 0	12 0 0	..
1819	12 6 0	12 6 0	12 6 0	..	..	..	12 6 0	..	..
1820	9 16 9	10 0 0	10 6 0	11 6 0	12 5 0	..	..	11 6 0	..
1821	8 15 6	8 15 6	8 15 6	9 5 6	11 14 0	13 13 0	8 15 6	9 15 6	..
1822	8 0 0	8 0 0	8 0 0	10 3 0	..	..	8 0 0	..	..
1823	8 4 0	8 4 6	8 4 6	9 4 6	..	..	8 4 0	9 4 0	11 4 0
1824	9 2 0	9 2 0	9 2 0	..	11 6 0	..	9 2 0	..	..
1825	13 15 0	13 15 0	14 6 0	..	..	..	14 6 0	15 6 0	..
1826	10 6 0	10 6 0	11 6 0	12 3 0	14 3 0	..	10 6 0	..	..
1827	9 13 0	9 13 0	10 0 0	..	11 7 0	13 7 0	9 13 0	10 7 0	11 7 0
Feb. 1828	8 9 0	8 9 0	8 9 0	..	..	13 0 0	8 9 0	9 10 0	11 0 0
July 1828	7 9 0	7 9 0	7 9 0	..	..	..	7 9 0	..	10 5 0
1829	6 0 0	6 0 0	6 0 0	..	..	..	6 0 0	..	..
1830	6 0 0	6 0 0	6 0 0	7 0 0	9 0 0	11 0 0	6 0 0	..	..
1831	5 10 0 6 0 0	5 10 0 6 0 0	5 10 0 6 0 0	6 10 0 7 0 0	9 0 0	11 0 0	5 10 0 6 0 0	..	..

In 1806 the difference between common sizes and half-inch was nearly 7*l.* sterling per ton. It required twenty-five years to bring it down to the present difference of about 1*l.*

" B. B. Howell, Esq.

" Sir,—I have the honour to hand you the following prices of iron in Sweden, from 1815 to 1831, and you may consider the Russian new sable was at the same prices, and P.S.I. at 20*s.* sterling per ton higher, at the same periods. Your's, &c.

(Signed) " N. Saltus."

* Page 237.

		£	s.	d.			£	s.	d.
March	1815	12	0	0	September	1824	10	7	6
July	1816	13	10	0	December	1824	11	5	0
October	1816	12	10	0	April	1825	14	3	0
March	1817	13	10	0	September	1825	14	19	0
June	1817	14	0	0	June	1826	12	0	0
February	1819	16	10	0	July	1827	12	9	0
December	1819	13	3	0	October	1827	13	5	0
January........	1820	14	10	0	December	1827	13	5	0
June	1821	13	5	0	September	1828	13	15	0
September......	1821	11	14	0	May	1829	13	15	0
November	1822	11	10	0	June	1829	13	9	0
April	1823	12	4	0	September	1829	12	19	0
August	1823	11	10	0	December	1829	12	0	0
December	1823	11	0	0	April	1830	11	0	0
March	1824	11	5	0	May	1831	10	10	0
August	1824	10	11	0					

Wholesale prices of hammered bar-iron in the sea-ports of the United States :—

Years.	Dollars.	Years.	Dollars.
1793–1796	90 to 95 per ton.	1816	110 to 120 per ton.
1797–1798	100 ,, 105 ,,	1817–1820	90 ,, 100 ,,
1799–1800	95 ,, 100 ,,	1821–1822	85 ,, 95 ,,
1801	110 ,, 120 ,,	1823–1824	90
1802–1806	105 ,, 110 ,,	1825–1826	105
1807–1809	110 ,, 115 ,,	1827	100
1810	115 ,, 120 ,,	1828	105
1811–1812	110 ,, 115 ,,	1829	100
1813	115 ,, 125 ,,	1830	90
1814	125 ,, 145 ,,	1831	75 ,, 85 ,,
1815	130 ,, 150 ,,		

APPENDIX F.*

STATEMENT C.

Showing the effects of a tariff of protection on the article of iron at Pittsburgh and Cincinnati :—

In the years 1818, 1819, and 1820 bar-iron, in Pittsburgh, sold at from 190 to 200 dollars per ton. Now the price is 100 dollars per ton.

In the same years boiler-iron was 350 dollars per ton. Now at 140 dollars per ton.

* Page 237.

Sheet-iron was but little made in those years, and sold for eighteen dollars per cwt. Now made in abundance, and sold at eight and a half dollars per cwt.

Hoop-iron under same circumstances—was then 250 dollars, and is now 120 dollars.

Axes were then twenty four dollars per dozen, and are now twelve dollars.

Scythes are now 50 per cent. lower than they were then—as are spades and shovels.

Iron hoes were, in these years, nine dollars per dozen. Now a very superior article of steel hoes at four to four and a half dollars.

Socket shovels are made at four and a half dollars by the same individual, who, a few years ago, sold them at twelve dollars per dozen.

Slater's patent stoves, imported from England, sold in Pittsburgh at 350 to 400 dollars. A much superior article is now made there, and sold for 125 to 150 dollars.

English vices then sold for twenty to twenty-two and a half cents. per lb.—now a superior article is sold at ten to ten and a half.

Braziers' rods, in 1824, were imported, and cost fourteen cents per lb., or 313 drs. 60c. per ton. Now supplied at any amount of a quarter to three-eighths diameter, at 130 dollars per ton.

Steam-engines have fallen in price, since 1823, one-half, and they have one-half more work on them.

The engine at the Union Rolling Mill (Pittsburgh), in 1819, cost 11,000 dollars. A much superior one, of 130 horse-power, for Sligo Mill, cost, in 1826, 3000 dollars. In 1830 there were made in Pittsburgh 100 steam-engines. In 1831, 150 were made, averaging 2000 dollars, or 300,000 in that article alone.

A two-horse power engine costs 250 dollars; six-horse 500 dollars; eight to nine-horse 700 dollars. These last are the prices delivered and put up.

At least 600 tons of iron, made in Pittsburgh, are manufactured into other articles before it leaves the city, from steam-engines, of the largest size, down to a threepenny nail.

Eight rolling and slitting mills, of the largest power, are in the city of Pittsburgh—five of which have been erected since 1828.

Thirty-eight new furnaces have been erected since 1824, in the

western parts of Pennsylvania, and that part of Kentucky bordering on the Ohio River—most of them since 1828.

The quantity of iron rolled at Pittsburgh was—

In 1828	....	3291·19 tons.
1829	....	6217·17 „
1830	....	9282·2 „

being an increase of nearly 200 per cent. in two years.

The above facts were furnished by members of the committee residing at Pittsburgh, who vouch for their accuracy.

One fact there stated, suggests the following remarks to the committee: To the report of the select committee of the Senate of the United States, on the subject of iron, is appended, among other papers, one in which it is stated, that—"it is now ascertained that the superiority of England over France is entirely due to the cheapness of iron; a six-horse steam-engine, for instance, in France, costs, on the average, at least 500 dollars more than in England, owing to the cheapness of iron in Great Britain. It is still dearer in the United States than in France."

Here it is asserted that a six-horse power steam-engine costs 500 dollars more in France than it does in England, and that it is still dearer in the United States than in France. Now, it so happens that, in the United States, at Pittsburgh, a steam-engine, of that power, can be put up, ready for action, for the identical sum of 500 dollars.

PRICES OF IRON AT CINCINNATI.

1814 to 1818—bar iron 200 to 220 dollars per ton—now, 100, 105, 110. The fall in prices has been nearly as follows:—

1826,	bar-iron assorted,	125	to	135	dollars.
1827	„	120	„	130	„
1828	„	115	„	125	„
1829	„	112½	„	122½	„
1830	„	100	„	110	„
1831	„	100	„	110	„

Castings, including hollow ware—1814 to 1818—120 to 130 dollars per ton; present price sixty to sixty-five, and the quality much improved.

4

APPENDIX G.*

STATEMENT D.

The duties on iron imported into the United States were—1804 to 1812—15 per cent.; double war duties from 1812 to 1816. In 1816, duties, rolled iron thirty dollars per ton—hammered nine dollars. The law of 1816, fixing the duties at these rates, ruined many of the manufacturers, and compelled them to abandon their works. By the Act of April 20, 1818, the duty on hammered iron was raised to fifteen dollars. This, in some measure, revived the manufacture, and many who had abandoned, resumed their operations. The foreign manufacturer, to keep possession of the market, offered his iron at a less price, so that there was an actual decline here. In 1824 the duty on hammered iron was raised to eighteen dollars, and in 1828 to 22 drs. 40c. These additions to the duty had no permanent effect in raising the price. The foreign manufacturer could not advance his prices beyond those of 1824, because the American iron maker supplied the market at those rates; and iron, at a duty of 22 drs. 40c., sells at less than it did at one of nine dollars. The foreign manufacturer has been compelled to take the additional duties from his profits—and these deductions from his profits have been paid into the Treasury of the United States, without adding to the price paid by the American consumer.

The following table shows the operation of the additional duty levied since 1818 on hammered iron alone :—

	Tons.	Duties.
1818—imported of hammered iron	13,931	Ds. 208,950
1819 ditto ditto ditto	16,160	242,394
1820 ditto ditto ditto	19,531	272,877
1821 ditto ditto ditto	15,374	230,413
1822 ditto ditto ditto	26,373	378,641
1823 ditto ditto ditto	29,014	435,210
1824 ditto ditto ditto	21,298	383,364
1825 ditto ditto ditto	23,085	428,490
1826 ditto ditto ditto	23,837	427,066
1827 ditto ditto ditto	21,718	390,924
1828 ditto ditto ditto	33,155	663,100
1829 ditto ditto ditto	29,202	654,141
1830 ditto ditto—estimated.†	29,202	654,141
	301,880	5,369,711
Duties at 9 dollars, the rate per law of 1816		Ds. 2,716,920
Gain in the Treasury, at the expense of the foreign manufacturer		2,652,791

* Page 239.

† Since ascertained to be 30,973 tons, of which only 439 tons were British. The

APPENDIX H.*

STATEMENT E.

The following calculations were made by Hardman Phillips and George Valentine, Esqrs., and are derived from the average returns submitted to the committee from two counties (those most extensively engaged in the manufacture of iron in Pennsylvania), namely, Centre and Huntingdon, and have been carefully verified by a comparison with returns from seventy-three furnaces and 132 forges.

For each ton of bar-iron and castings made, the following agricultural produce is found to be consumed :—

Twenty bushels wheat and rye—averaged at 75 cents.			....	drs. 15·00
Fifty-seven pounds pork	ditto	5 ,,	....	2·85
Forty-three ditto beef	ditto	4 ,,	....	1·72
Ten ditto butter	ditto	12½ ,,	....	1·25
Two bushels potatoes	ditto	30 ,,	....	·60
Half ton hay	ditto	drs. 7	....	3·50
For every ten tons of bar-iron one horse is employed one whole year, worth 100 drs., and experience shows that the mortality among horses so employed is, per annum, one in seven, and constitutes a charge of, per ton				1·43
For fruit and vegetables, of which no return has been made, we feel justified in putting down			....	1·00
				drs. 27·35

which, multiplied by the quantity of bar-iron and castings, will give the sum of 3,415,850 dollars, paid by the iron manufacturers, and those employed by them, to the farmers.

The same returns enable them to state that every five tons of iron, as above made, requires one able-bodied man throughout the year, or in the whole 24,979; and, as it appears that, upon an average, each one of these has four dependent upon him, it follows that 124,895 persons are supported by this branch of industry, in its first stages; and the average of the wages of the workmen being fully one dollar per day, or say 300 per annum,

small amount of the latter importation is the best possible evidence of the bad quality of English iron, as stated in subsequent pages, and of its unfitness for the usual purposes to which hammered iron is applied. All such iron pays the same duty.—*Permanent Committee.*

* Page 241.

they receive for wages, in the whole, the large sum of 7,493,700 dollars for the labour of one year.

The expense of transporting this iron to the different markets, by land and water, may be estimated at an average of 10 dollars per ton, amounting to 1,248,940 dollars; the whole of which is distributed among those engaged in the transportation and coasting trade of the country, and subdivided among those who furnish subsistence to the many persons employed, and in furnishing means for this branch of the business.

APPENDIX I.*

STATEMENT F.

New York, 29th October, 1831.

To the Committee on Iron and Steel, appointed by the Convention of the Friends of Domestic Industry, now in Session in this City.

The following examination of the memorial of the workers of iron, and others, in Philadelphia—presented to Congress in January, 1831—we submit to you for the use of the convention:—

1. Under their first head the memorialists embrace two subjects; first, the high duty on English iron; and, secondly, its quality.

With respect to the rate of duty, we will answer when we review what is said on the same subject, under their sixth head.

With respect to its quality, the memorialists contradict the report of the committee of the senate,† which pronounced it "bad;" and say that "English iron is preferred for various purposes, on account of the decided superiority it possesses in various qualities—for its strength of cohesion—its excellence in welding, surpassing every other iron, as in chains and anchors, in rails for railways, spikes, and bolts—on account of the superior manner in which it is prepared in all the various forms required, as well as from its acknowledged superiority in durability—and for wheel tuyeres for the same properties, as well as from the greater evenness with which it is always drawn"—and concludes by saying,

* Page 245.

† This refers to a report of a committee of the Senate, made at the previous session, adverse to the memorialists.

"the American, Swedish, Russian, and English iron all sell in the Philadelphia market at about 100 dollars per ton.

In answer to the above, we would remark, that the small quantity of English iron imported, in comparison with the total imports of iron, itself confutes their statement as to its superior quality, and conclusively shows that the properties it possesses are not in great requisition here. The ratio of English iron imported being less than one to seven, notwithstanding the advantage it has over other foreign iron, of being procured of any size, and at a cost of 20 per cent. less.

The little use to which this iron is put will appear more manifest, when compared with the total quantity consumed, as will be seen by referring to our statement under the sixth head, being only 1-39th of the total consumption, and this, too, with its advantages as to size and price, above-mentioned. These facts show incontestably in what repute this iron is held by customers. We have been importers, and wholesale and retail dealers in the article, for many years, and our experience is, that the united testimony of all consumers is in direct variance to the statement of the memorialists, as to its good quality; the low price and the convenient size in which it may be obtained, is as a general remark, the only reason why it is sold at all.

The memorialists particularise for what purposes this iron is decidedly superior; first, as for chains and anchors, on account of its strength of cohesion and excellence in welding. If it has more strength of cohesion than other iron, it is new to us, as well as to all the workers of iron that we have inquired of on the subject. We have no facts before us of the strength of English iron, but we have a certificate from Commodore Hull, commandant of the navy yard at Washington, giving the strength of chain iron lately supplied by the New Jersey Iron Company. The $1\frac{1}{2}$-inch round broke with sixty tons weight on it; the $1\frac{1}{8}$-inch round broke with forty-one tons weight on it.* If the memorialists have any trials to show that English iron has more strength of cohesion than this, they are right; but we have no idea that the English iron sent to this country will bear any comparison with the above. As to its superiority in welding, we have inquired of

* The proof required by government for $1\frac{1}{2}$-inch round iron is thirty-five tons, for $1\frac{1}{8}$-inch round iron sixteen tons.—(I find that, at a trial at a chain cable factory in $1\frac{1}{2}$-inch iron broke at forty-three tons.—B.B.H.)

several blacksmiths as to the facts, and they universally say, that American iron is better for welding. As to its being used for anchors in this country, we have made inquiries, and cannot ascertain that any is used for that purpose in the anchors that come to New York. It appears very strange that American iron for anchors should be sold at 115 dollars per ton, and preferred at that price, while English iron can be bought at 72 dollars, if the English is superior.

With respect to its being superior for railways, we cannot conceive how the fact could be ascertained, as an experiment, we think, could not have been made in this early stage of railways in this country; but as to its superiority for spikes and bolts, we positively deny it. Being sellers of both English and American iron, we know that the American iron is always preferred as to its quality. The English is only used in small vessels of seventy tons and under, while, in larger vessels, the American iron, at 20 per cent. higher price, is universally preferred.

As to the " superior manner in which it is prepared in all the various forms required," we would reply—that the rolling-mills in this country make all the sizes required quite as handsome, and far better in quality, than the English.

Lastly, with respect to its " superiority for wheel tuyeres." The experience and information of the memorialists is in direct opposition to ours; nor can we conceive how persons would continue, for years, to purchase Swedish and American iron for that purpose, as they do, at 25 per cent. higher price, if the English was superior. It is, without question, the poorest iron for that use that can be purchased, and is only used on account of its low price, which, instead of being five dollars per cwt., we sell by the single ton at 25 per cent. less—viz., 3 drs. 75c. per cwt.

2. The second head of the memorial speaks of the manner of making iron in England, which requires no answer.

3. Under this head the memorialists speak of the hardships of purchasing imported iron, of small size, at a high price, in consequence of the duty being three and a half cents. per lb. on it. That difficulty is now in some measure removed, as one factory in New Jersey is prepared to supply the United States with a better article, and at less price, than it can be imported; and the rolling-mills now erecting in different parts of the United States, will be able, from next spring, to furnish all the iron that pays a duty of

three and a half cents. per lb., at less price, and better quality, than it can be imported for.

The following statement will show the comparative price of common bar-iron and half-inch round in England, from 1806 to 1830 :—

Common bar-iron.				Half-inch round.			
1806	£20	10	0	1806	£27	0	0
1809	14	0	0	1809	18	0	0
1815	11	0	0	1815	16	0	0
1822	8	0	0	1822	10	5	0
1830	6	0	0	1830	7	10	0

From the above it appears that the cost in England, as late as 1806, of common bar-iron, was 20*l.* 10*s.*, and at the same time the price of half-inch round was 27*l.*, or 6*l.* 10*s.* higher, which is a greater difference than is now made by our rolling-mills; and we do not doubt but that the difference in price between bar-iron and small round, made by our mills, will be reduced as the quantity made is increased, and our factories become more perfect, as has been the case in England. From 1806 to the present time the price of iron in England has been gradually reduced in proportion to the increase of the rolling-mills, perfection of machinery, and skill of workmen. The present difference between bar-iron and half-inch round is but 1*l.* per ton. The quantity made in England in 1787 was 30,000 tons; 1796 was 130,000 ditto; 1830 was nearly 700,000 ditto.

4. Requires no answer.

5, 6, 7. Under these heads the memorialists state that the present rate of duties on the raw material being so much higher than on the manufactured article, gives a decided monopoly to the manufacturers of hardware at Sheffield and Birmingham, that many articles can be imported at or under the present cost of bar-iron—that they " have no other object in the relief they now pray for, than to enable them to bring their own industry into fair and equal competition with the foreign manufacturer." Here rests the whole ground of complaint of the memorialists—viz., on the inequality between the duty on what they call the raw material and on the manufactured article. In order to substantiate the above, they instance a number of articles of hardware, which they endeavour to show can be imported cheaper than the raw material itself. We will first examine their statements of the articles particularised,

and endeavour to show that they do not prove the point they wish to establish, and then show the true proportion between the duties on hardware and on the raw material; and we think it will be made to appear that the manufacturers of hardware in this country, instead of being less, are protected to a much greater extent than those of iron—which, if proved, will show that the whole ground of their complaint is without foundation. The first articles they instance are hammers and sledges for blacksmiths, which they say " are imported at 4 drs. 66c. per cwt., which is 33½ cents below the cost of the bar-iron in this market, exclusive of duty." We have imported hammers and sledges regularly for many years. The poorest article we ever heard of being sent to our market cost seven and a half cents per pound, those we import are of a quality fit for use, and cost eight and a quarter, which is 9 drs. 25c. per cwt., while we sell English bar-iron at retail for 3 drs. 75c.—leaving a difference of 5 drs. 50c. per cwt. in favour of the manufacturer of these articles in this country. The next article they instance is wheel tuyere, which they say can be imported at less cost than bar-iron. We have never known of its interfering with the sale of iron for that purpose. There has, indeed, been two lots of it imported into New York, but the house who had it found a difficulty in selling it, and told us to-day that they would have no more.

The next article they advance is frying-pans, and state that they are, and ever have been, imported at a less price than the cost of sheet-iron—meaning to draw a comparison between the cost of iron in sheets and in its manufactured state. This comparison is evidently unfair, and calculated to deceive. Frying-pans are not made of sheet-iron only, but partly of sheet-iron and partly of bar-iron. We import the sheet-iron part of frying pans—viz., the bowls separate from the handles, and they cost, by an invoice, dated January, 1831, ten cents per pound to import, while the sheet-iron, in sheets, costs only six cents per pound—leaving a difference of four cents per pound in favour of the sheet-iron in a manufactured state. Frying-pans, at the same time, cost six cents per pound. The next article presented by them is tea-trays. They state that tea-trays, with one coat of japan, can be imported at 83 drs. 72c. per ton, while the iron required for the same purpose is selling at from 160 to 170 dollars per ton. We have imported tea-trays for many years, and

are totally unable to devise how this can be done. The largest tray ever imported, or, if imported, would be used, is thirty by twenty-two inches, and the poorest article that we ever saw cost fifty-two cents each tray to import, and weighed four pounds, which is thirteen cents per pound, or 290 dollars per ton, instead of 83 drs. 72c., as stated by the memorialists. If tea-trays were imported to cut up for stove-doors, blowers, &c., as stated in the memorial, the edges, which are turned up, must be cut off, or flattened to a plain surface. And unless the memorialists should be more successful than ourselves in an experiment made to ascertain whether it could be flattened out, as it was before it was made into a tray, that business would not amount to much. The smith into whose hands we put it, gave it its proper heat, and endeavoured to flatten it under his hammer, but the edges burst, and the iron cracked at the angles where it had been bent to form a rim—so we were convinced that the edges, or rims must be cut off, which we had done for the sake of experiment—the weight of which was one and a half pounds—which, being only scrap-iron, is not worth more than twenty-five dollars per ton; and this loss, added to the cost of the tray, would bring the iron imported in the shape of trays, suitable for other purposes, as follows:—

One ton of trays, as above, cost	291·00	dollars.
Loss in rims cut off—37 per cent.	109·00	„
Labour in cutting—one cent. per tray....	5·60	„
	405.60	„
Deduct $7\frac{1}{2}$ cwt. scrap iron—worth 25 dollars per ton	9·38	„
Making cost of sheet-iron imported by this process, per ton	396·22	„

The cost of importing sheet-iron of the thickness of tea-trays is 135 dollars per ton, instead of 160 to 170 dollars, as stated in the memorial. We do not say that what the memorialists state is untrue—but we do know the above statement to be correct, and cannot conceive how it could be reduced to 83 drs. 72c. per ton, when we make them to cost 396 dollars per ton.

The memorialists next show that iron knitting-needles can be imported cheaper than wire No. 18. This is true, because there

is so little labour in cutting wire into knitting-needles. The amount of this article sold per annum, we think, may amount to 200 dollars.

The memorialists next proceed to show that the duty on wrought nails precludes all possibility of competition between the domestic and foreign manufacturer. The fact about the nail making is—that the manufacture of nails (whether cut or wrought, it matters not) has been brought to such perfection in this country, that 40,000 tons are annually made here, while only 266 tons are imported.

The memorialists further state, that the duty on wire being high, operates against the manufacture of wire sieves and fenders. We think they are unhappy in the selection of these articles also, to prove their point—as, from all the information we are able to collect, there are no wire sieves nor fenders imported into New York, but that market is supplied exclusively by the domestic labour.

The next article they bring forward is horse-shoes, which they say can be imported at the price of bar-iron, and have become an article of import. This might have been said for many years past, as attempts have been made, from time to time, to import them to advantage—but all experiments, within our knowledge, have failed. We ourselves made the attempt about three years since, but could not do it to a profit, and are perfectly willing that others should purchase experience at the same cost. Common English iron would not answer for horse-shoes. We have imported best English iron in bars for that purpose, but never could get any good enough. The American and Swedish are exclusively used.

The last article they instance is hoops for coopers, bent and rivetted, ready for use, which they say can be imported cheaper than the hoop iron. This may be true, for aught we know, but we have never heard of any having been imported—yet are in the practice of importing and selling hoop-iron—and if there had been any competition from that quarter we think we should have known it. For our part, we do not feel disposed to enter into the import of finished hoops, and it appears that others in the trade have a similar indisposition. We leave the reader to judge whether, on the few articles they have selected to show that the manufactured article can be imported cheaper than the raw mate-

rial, they have proved the point, which, if they have proved, would establish the principle as to a few articles only, and not on hardware in general.

We now proceed to show the true relative proportion between the duties on hardware and on the raw material. The memorialists say that "the duty on iron is from 159 to 282 per cent., or from six to eleven times the duty on hardware." When they say the duty on iron is from 159 to 282 per cent., they speak in such general terms as to convey the idea that the duty on iron generally is that much. We will first show what is the average duty on imported iron.

The quantity of iron annually imported, as stated by the memorialists, is as follows: —

	Tons.	Duty per ton. Dollars.	Total duty paid. Dollars.	For 5 years past cost per ton, including duty. Dollars.	Total cost, including duty. Dollars.
Swedish and Russian ..	29,486 ..	22·40 ..	660,486 ..	95·00 ..	2,801,170
English bar-iron	3,332½ ..	37·00 ..	123,302 ..	75·00 ..	249,938
Sheet, rods, &c.	1,168 ..	78·40 ..	91,571 ..	130·00 ..	151,840
	33,986		875,359		3,202,948

By the above statement, it appears that the average duty on all the iron annually imported is less than twenty-six dollars per ton.

The following statement shows the annual consumption of iron in this country, as per report made to the convention of manufacturers of iron, lately held in Philadelphia:—

	Tons.
In 1830 there was made at 202 furnaces	155,348
Of which was made into castings	28,273
	127,075
Which rendered into bars, at 28 cwt. per ton. would yield	90,768
There was made of bloomed iron..................................	5,853
Total bar-iron made annually in the United States	96,621
Add the quantity imported	33,986
Annual consumption of bar-iron in the United States	130,007
Besides what is made from the blast-furnaces into castings	28,273
Iron consumed in the United States, annually	158,280

Though the duty on a small portion of the iron imported is high, yet, as we have shown that the average duty is less than twenty-six dollars per ton, while the proportion of the iron imported that pays thirty-seven dollars per ton is less than one-seventh of the total imports, though it sells at 20 per cent. less than any other iron, and that part which pays a duty of 78 drs. 40c., is only one-thirtieth of the entire importation.

But when we compare the quantity of iron consumed in this country that pays a duty of thirty-seven dollars, or 78 drs. 40c. per ton, with the total consumption of bar-iron—to say nothing about iron made into castings—it sinks into insignificance. The proportion of that paying thirty-seven dollars duty being only 1-39th part, while that paying a duty of 78 drs. 40c. is only 1-112th part: to which, if we add the iron made from the blast-furnaces into castings, it will sink still lower.

In order to ascertain the actual duty paid per ton on iron, in the shape of hardware, we have taken an account of all our imports of hardware, from June to November (this year), as well as those of another hardware house, for the same time—viz., Messrs. Hyers—the result is as follows:—

	Cost sterling.	Tons.	c.	q.	lb.	Duty paid.	Duty per ton.
G. and W. imports..	£4314 ..	59	15	1	6	.. drs. 6,180·24 ..	drs. 103·40
Hyers ditto	5710 ..	69	19	1	4	.. 7,112·02 ..	104·50

The approximation of the duties paid per ton by the Messrs. Hyers and ourselves, renders it certain that the above is as correct a view of the average duty paid on hardware as could be obtained *—from which we draw the following results:—

There was imported of hardware in 1828—9	drs. 3,346,146
The duty upon which, estimated as paid in the two importations above-mentioned, is 30 per cent.	1,003,843
The weight of which, taking the two importations stated as the data, was 9763 tons	
If the American manufacturer of hardware had his iron at the average rate duty paid on iron, it would have been, on 9763 tons, at 26 drs. per ton..	253,848
And he would have received a clear protection of................	drs. 749,995

that is, the importer of the manufactured article would have had to pay four times as much duty as the manufacturer who imported

* It included every article usually imported, subject to specific as well as *ad valorem* duty, anvils, &c. No part could probably be a more fair specimen of the whole imported.

the raw material and worked it up here; or, if the manufacturer of hardware had imported his iron, and paid the duty, as on English iron, of thirty-seven dollars per ton, as calculated by the memorialists, he would have paid 361,231 dollars, and received a clear protection of 642,612—that is, the importer of the manufactured article would have had to pay nearly three times as much as the importer of the raw material, who worked it up here.

From the above statement of facts, the reader can judge how much weight should be given to what the memorialists say as to the exclusive protection given to the raw material over the manufactured article.

8. Under this head the memorialists recommend that pig-iron should be admitted free of duty. They exhibit a calculation, to show that, if pig-iron was admitted free, bar-iron could be made here at forty dollars per ton. We will examine the correctness of these statements upon their own ground. We imported a parcel of pigs from England, about the time the memorial was written, and so have the expenses of importation, which are as follows:—There are two iron districts in England—Wales and Staffordshire—we will take the price of a ton of pigs in Wales, as it is less there, and more favourable to the memorialists:—

	£	s.	d.	
Cost of one ton pigs in Wales	£3	5	0	
Freight and insurance to Liverpool	0	8	0	
Charges at Liverpool	0	1	8	
Export Duty	0	0	4	
2½ per cent. commission for purchasing	0	1	9	
	£3	16	9	
Exchange, insurance, 8½ per cent.	0	6	6	
Freight to New York	0	10	0	
	£4	13	3 is	drs. 20·70
Cartage in New York to store				·50
Merchants' commission and storage, 5½ per cent.				1·05
Transportation to nearest works				3·00
				25·25
28 cwt. to make one ton bar-iron				10·11
Cost of pigs to make one ton bars				35·36
200 bushels of charcoal to convert pigs into blooms, at 5 cents				10·00
Labour on ditto				7·00
175 bushels of charcoal to convert blooms into bars				8·85
Labour on ditto				5·00
Re-transportation to market				3·00
Water privileges, dam, and overseeing				2·00
Total				drs. 71·21

Cost of bar-iron made of imported pigs, free of duty; and this, the memorialists say, could be made for forty dollars per ton—and, if puddled, less. We have shown that it could not be done for anything like the money with charcoal—neither could it be puddled, as we know by experience. The consequence of a repeal of the duty on pig-iron would be—not that we could make bar-iron here at forty dollars per ton, but it would cost us 71 drs. 21c., which is more than we now pay for iron imported from England, made of the same material; and, in doing so, would destroy all the furnaces within the influence of the imported pig-iron.

That pig-iron could be imported, free of duty, cheaper than we can make it in this country with charcoal, is without question; but suppose it to be admitted free, what would be the consequence? From these pigs we could either make an iron that would suit our wants, or we could not. If it were good enough for general use, all the furnaces within the reach of its influence must stop, of course, because they would be undersold—the selling price of American pigs being from twenty-eight to forty dollars. If it would not make a better article than we now import from England, made of the same pig-iron, we should not want more than we now take; for, if the quality was adapted to our wants, we would consume it now—its price being a sufficient inducement. By granting the prayers of the memorialists to admit pig, boiler, scrap, blooms, &c., free, and bar-iron 25 per cent. *ad. val.* duty, it is manifest that we must either substitute an inferior article of English iron in place of that made in this country, or, if we can make a better article from the pigs than they do, we will cause a considerable portion of our furnaces to stop, which would destroy more capital, and throw out of employ more individuals than would be employed in manufacturing hardware in very many years.

By granting the fourth, you would destroy those manufacturers of wire who have commenced since the tariff of 1828, in the faith of the government—one of whom told us that he can make, this year, wire enough to supply the United States, and sell it at a less price than it can be imported.

By granting the last, you would cut off all inducements to the manufacture of steel, which we think (and we have given the subject some investigation, with a view to manufacture) can, and will, be successfully accomplished. Lastly—what would be the

state of our country in case we had to depend upon a foreign supply for so necessary an article as iron, and especially when our main dependence would be upon England, who, in time of war, could blockade our ports—stop supplies—and cause greater evils than the nation, we think, is willing to expose itself to?

From the preceding statements, it is manifest that the quantity of iron manufactured in this country is not inconsiderable, as the memorialists call it—but is about four times as much as is imported in any shape, which is more than is made in any other country, excepting England—more than two and a half times as much as is exported from Sweden—and as much as was made in England at the beginning of this century.

The amount annually manufactured in the United States, is			158,280 tons,
while the amount imported in bars, &c., is	33,968		
Imported in hardware	9,763	43,731	,,

The value of American iron, as per report of the committee on the subject of iron, appointed by the convention lately held in Philadelphia, is			11,444,410 dollars,
while the value of that imported in bars, &c., including the duty, is	3,202,948		
Value of iron on 9763 tons, imported in the shape of hardware, estimated at the same rate as the above	678,670	3,881,618 dollars.	

From which it appears that the total quantity of iron imported in every shape is about one-fourth of what is made here, and its value about one-third.

It is incumbent upon the memorialists to show whence we are to get a supply to meet the deficiency occasioned by the suspension of a large portion of our furnaces. For our part, we do not see how we could get a supply, unless we could make a better article out of English pigs than they send to this country. Any one who is acquainted with the situation of Russia, with respect to the quantity we could get from thence, and the practicability, under the existing state of society and civil government, would think an increase of 10,000 tons a large calculation. Sweden exports only 50,000 tons per annum, that being the total quantity the law allows to be made for foreign consumption, as each factory is confined to a certain quantity in proportion to the wood-

land owned; and the woodland that is proximate enough to be used for iron making has been brought into use for that purpose long since. Of that 50,000 tons we take 20,000, and a considerable portion of the remainder—say 10,000 tons (including the steel-iron, which the English monopolise)—go to England; the remaining 20,000 tons go to the continent—so that we cannot get much more from thence without paying more for it than others can pay. But suppose we get from Sweden an increased supply of 15,000 tons, there remains unsupplied yet upwards of 71,000 tons, which the memorialists will please inform us where to obtain, unless the price should advance enough to enable our manufactories to go into operation again? In which case the proposed change would be of no avail.

We will conclude with showing the comparative value to the country of the present manufacture of iron and of hardware—if we should make all the hardware we consume, and import the iron for it, as proposed by memorialists. Made in the United States 158,230 tons iron—value .... 11,444,410 dollars.

Total amount of hardware imported—value	3,346,146	
The value of 9763 tons iron to be imported to make this hardware, would be, free duty	390,520—	2,955,626 ,,

they would, therefore, nearly destroy the manufacture of an article valued at 11,444,410 dollars to establish one valued at 2,955,626 dollars—even if we allow that all the hardware now consumed could be made in the United States.

We think we have proved in the foregoing statements—

1. That the quality of English iron, instead of being good, as the memorialists represent, is the worst iron in use.

2. That the duty on iron in bars, &c., instead of being from six to eleven times higher than the duty on iron imported in the shape of hardware, as stated by the memorialists, is but one-fourth as high, inasmuch as the average duty paid on iron in bars, rods, sheets, &c., is twenty-six dollars, and that imported in the shape of hardware is 104 dollars per ton.

3. That the quantity and value of iron actually manufactured in this country is not insignificant in amount, as there is made here per annum 158,000 tons—11,444,410 dollars, while that imported in the shape of bars and hardware is 43,731 tons—value, includ-

ing the duty, 3,881,618 dollars; and of course the statement made by the memorialists is not true, that there is only made in the United States 35,000 tons, and imported 81,000 tons.

4. That by granting the prayer of the memorialists, you would almost annihilate the manufacture of an article which has grown up under a protection to the value of 11,444,410 dollars to establish one of 2,955,626 dollars. Yours, respectfully,

GREEN AND WETMORE.

APPENDIX K.*

STATEMENT G.

B. B. HOWELL, Esq. *New York, Oct.* 31, 1831.

Dear Sir,—In conformity with your request, I herewith give you a statement of the iron produced in Litchfield, county Connecticut, with the manufactures of iron and steel in said county, to which I have added the other productions of the county, as estimated by the delegates to the convention from that county. It may not be perfectly accurate, as a portion of it is founded upon conjecture; but the total will rather fall short of, than over-run, the true amount, as a very considerable list of articles, each of small comparative value, are entirely omitted.

I am, very respectfully, your obedient servant,

JOHN M. HOLLEY.

	Value.
Pig and bar-iron, &c. .... drs.	293,000
Manufactures of iron, &c.—	
Scythes	56,000
Hoes	7,150
Axes	26,500
Rat and mouse traps	9,500
Shoe tacks and sparables	40,000
Shovels and spades	6,500
Augers	200
Steel	8,000
Pitchforks	20,000
Ploughs	3,800
	drs. 177,650
Other productions—	
Wool	151,000
Woollen cloths	215,000
Cotton ditto	15,000
Hats	70,700
Shoes and boots	112,000
Carriages and waggons.... drs.	38,000
Clocks	382,000
Leather	181,000
Cabinet work and chairs	27,000
Cordage	500
Machinery, part wood and part iron and steel	19,000
Brick, clay furnaces & marble	38,200
Rakes and brooms	5,000
Lime	5,000
Musical instruments	2,200
Buttons	20,000
Cheese	115,000
Butter	17,600
	drs. 1,414,200
Pig and bar-iron	293,000
Manufactures of iron, &c.	177,650
	drs. 1,884,850

* Page 251.

APPENDIX L.*

STATEMENT H.

Manufactures of Delaware County,† Pennsylvania.

To the Delegates to the Convention to be held at New York.

The committee appointed, in pursuance of a resolution, adopted at a meeting of citizens of Delaware county, convened agreeably to public notice, in Chester, on the 17th inst., "to ascertain the number and extent of the different manufacturing establishments in the county; the quantity of manufactures produced; the quantity of raw material consumed: the number of hands employed," &c., report—That, from the short time to which they were necessarily limited, they have been unable to collect that full and complete information on the subjects committed to them, which the importance of these interests require; but, referring the delegates for more minute details of the distribution of our manufacturing and mechanical industry to a printed report (a copy of which is inclosed), taken by Benjamin Pearson, Esq., under the direction of a committee appointed for the purpose in 1826, your committee offer the following statement, made up of such details as they have been able to procure, in addition to their personal knowledge of facts, and they believe it will prove, in the aggregate, not far from correct.

October 22, 1831. JOHN P. CROZER, Chairman.

Mills and Factories.	Quantity per annum.	Kind.	Value per annum.	Persons employed.‡
4 Rolling & slitting........ 2 nail factories..	1,400 tons ..	300 tons sht. iron	drs. 45,000 ..	205
		600 ditto nails....	81,000 ..	
		500 ditto hoops ..	60,000 ..	
4 tilt mills......	......	edge tools, &c. ..	21,175 ..	30
13 paper ditto....	41,000 reams .	various..........	215,000 ..	400
13 cotton spinning	1,080,000 lbs.....	yarn	300,000 ..	720
3 cotton weaving	800,000 lbs. yarn	ticking, muslin, &c.	350,000 ..	400
woollens mill..	900,000 lbs. wool	flannel & satinetts	300,000 ..	350
	Total......................		drs. 1,372,175	2185

* Page 251.

† This small county contained 14,810 inhabitants in 1820.—*Per Com.*

‡ Including families.

APPENDIX M.*

STATEMENT I.—REPORT ON STEEL.

On the subject of steel, your committee reports, that, as no preparation whatever had been made for collecting information antecedent to this convention in New York, they are not able to supply it from any other source than what is attainable in this city. They have no time left for collecting and collating tabular statements or statistical reports of the quantity of steel imported and manufactured in this country; nevertheless, enough information has been acquired, in the course of a day, to satisfy the committee that the article in question is one that requires the continued protection of government. The committee assume the principle that, if steel can be manufactured now, or within a few years, to supply the wants of our own citizens, at a reasonable price, it cannot be an object towards which the legislature will be indifferent; and it is deemed expedient that even the limited information now produced should be disclosed, in order to encourage reflection, and secure that consideration which the article of steel unquestionably merits.

Without seeking further, the members of your committee are enabled, from their recollection, to enumerate fourteen steel furnaces in the following places, viz.:—Pittsburgh 2, Baltimore 1, Philadelphia 3, New York 3, York County, Pa., 1, Troy 1, New Jersey 2, Boston 1.

These furnaces are known to be now in operation, and of a capacity sufficient to supply more than 1600 tons of steel annually†—an amount equal to the whole importation of steel of every kind. But it should be observed, that steel, for common agricultural purposes, is not the best, although it is most used, and that American is quite equal to English steel, used for such purposes in England. American competition has excluded the British common blister-steel altogether. The price of blister-steel

* Page 251.

† Mr. Coates has subsequently requested the chairman of the permanent committee to add the following note:—This calculation is believed to fall far short of the quantity of steel made in the United States. It appears that the fourteen furnaces have only one batch, or blast, in a month—whereas two weeks are sufficient for conversion of iron into steel.

is less than it was before 1828, and, probably, as low as it ever will be—certainly as low as it ought to be, having a just consideration for the manufacturer and his customer. The only steel now imported from Great Britain is of a different and better quality than that just mentioned. It has been the laudable pride of American legislation to advance with the increasing enterprise of the people, and to encourage discoveries of those mineral treasures, towards which that enterprise might be profitably directed. The committee having shown the result of such countenance from government, in the instance of common blister-steel, may be allowed to anticipate the effects of its continuance, and that protection will be hereafter acknowledged as the parent of perfection.

Steel imported here, from all parts of the world, except England (although the German steel is freely employed in some branches of manufactures), amounts to so considerable a quantity, that the competition for ascendency in our own market must rest between that nation and this. We already supply ourselves, to her exclusion, with common steel; and, to give some idea how extensively it affects our manufactories, the committee will state two or three striking facts. The iron of this country, when properly made, has been found equal in quality to the Russian and Swedish iron used in England for conversion into steel, and, being so converted, is employed in making large and rough implements of manufacture and agriculture. It is used in the fabrication of ploughshares—it is worked up by shovel-makers—among whom one in Philadelphia uses more than fifty tons a-year. Scythe-makers are among the best customers of a steel furnace—and cross-cut and mill saw-makers use more than any other manufacturers. One factory of this kind, in Philadelphia, requires a ton and a half of steel per diem, for every working day of the year. These isolated instances may give some idea of the vast consumption of steel in the numerous factories of the United States, and for this purpose alone they are stated.

The English, however, continue to supply us with the superior qualities. These are—

1. Blister-steel, from iron of the Danamora Mines, in Sweden.
2. Sheer-steel, of the same origin.
3. Cast-steel.

As to the first, being the best quality of blister-steel; a house in Hull monopolises all the iron made from Danamora ore, under a

contract, by which the parties in Sweden are to forfeit 10,000*l.* sterling if they sell to anybody else—so that no other European country can furnish a good file, without resorting to England for the steel that is made of Danamora iron—this excelling all others in Europe for files, and many other instruments. The British manufacturers, aware of the advantages of their monopoly, continue to exact the same price for their steel delivered in America that they did before the duty on the Swedish iron was reduced in England, from 28·88 to 6·66 dollars per ton—thus proving that an article whose low duty approaches nearest to no duty (almost "free trade"), is charged to this country at a rate no less than before the reduction of duty took place in England.

It is, however, a cause for congratulation here, that iron, of similar, or equal, quality to that which has thrown all the advantages of manufacturing the best articles of cutlery into British hands, has been made recently, by improved processes, from the ore of Juniata, and both sides of the line between New York and Connecticut—the latter denominated the Ancrum, the Livingston, and the Salisbury ore. Steel is now made at Pittsburgh, and may be made in New York and Connecticut, bearing a fair comparison with the best hoop L L or Danamora steel that comes from England. No difference is observed where trials have been made, without disclosing to the judges the origin of either. Two establishments, one in New York and another in Pittsburgh, have justified this statement, and encouraged a hope that the products of our own mines, smelted by means of modern improvements in the construction of furnaces and application of the blast, and elaborated by machinery lately introduced, will rival the best quality of steel that England can furnish.

The second kind of first-quality British steel is called "sheer-steel." This is nothing more than blister-steel, drawn under a tilt-hammer into bars of the various sizes used in the fabrication of some articles of cutlery, and the finer kinds of edge tools. England has hitherto monopolised this branch also, from being in possession of the only European steel that would bear the expense of preparation, and from the perfection of her machinery. She has now the honour of transferring a portion of her experience and skill to the United States. Her workmen in steel, wanting employment or adequate recompense for labour at home, continually seek these among us; and it is believed that these may be afforded

to such an extent as to yield them support commensurate with their industry, and that ingenious men, who, under other circumstances, might have been compelled to pursuits not congenial with their education, or to be dependents upon public bounty, will become useful citizens, instead of idlers and beggars in the land.

The third kind of steel (best quality) is called " cast-steel," and this is made from the best blister-steel only. There is none made in the United States. Several attempts to make it with profit have proved unfortunate.

The causes of failure were—

1. The want of best quality blister-steel (of which only it can be made) at a reasonable price.

2. The want, or expense, of crucibles of proper quality, wherein the blister-steel is to be melted and smelted.

The first difficulty may be surmounted by the discovery that iron, well made, from the ores of Juniata, New York, and Connecticut, may be converted to the best blister-steel; and the second difficulty is believed to be at an end, since the explorations of the present year have disclosed the existence of clay analagous to that of Stourbridge, which is considered the best in the world for crucibles. Centre, Clearfield, and Lycoming counties (Pennsylvania), have yielded large specimens of clay that satisfy geologists, mineralogists, and chemists, of the identity of its properties with those of Stourbridge. Clay, in the vicinity of Baltimore, has been successfully employed in the manufacture of fire-brick, and may probably be used for the manufacture of crucibles for cast-steel, if properly prepared. The great impediment to the making of cast-steel has not arisen from any mystery in the art, but the want of strength in the crucibles. Black lead, and a variety of clays, have been tried, but the weakness of these materials have hitherto caused a loss to the manufacturer, because the crucibles made of them would not bear moving when the melted metal was in them (generally about 28 lbs). The Stourbridge was the only kind of clay that possessed the requisite qualities of preserving its shape and soundness when exposed to the greatest heat, and its strength and tenacity when moved for the purpose of discharging the melted metal. Capital, enterprise and perseverance will be engaged to bring this desirable material, so indispensable to the finer arts of cutlery and machinery, into market—if protection be continued to the efforts which our citizens are willing to make.

If these views are correct—we have steel for agricultural purposes in the greatest abundance;—we have steel (sheer-steel), for nicer purposes, and we may have cast-steel for the most refined articles of manufacture among ourselves. But this is not all, we may export our steel to Russia, Prussia, and France, in competition with England herself; and thus justify the further importation of foreign commodities which we can have the means of paying for. The subject of steel becomes more interesting as our investigation of it advances; but it is believed that the facts and inferences now set forth, will suffice to continue the protection already granted, and to procure time for more extensive practical development, which, if realised, will add to the means of domestic employment and beneficial intercourse with foreign nations.

[The preceding report on steel was presented by Mr. John R. Coates, of Philadelphia, to whom this branch of the subject had been specially referred, for a collection and arrangement of the facts; as was that on iron proper, to Mr. B. B. Howell, of New York, by the general committee on the manufactures of iron.]

GENERAL RECAPITULATION,

BY THE PERMANENT COMMITTEE.

	By the Report.	Supplementary Returns.	Total.
Bar iron made in the United States, tons	96,621	16,245	112,866
Pig-iron, the whole quantity made being computed as such	163,543	27,994	191,536
Value .... dollars			13,329,760
Men employed.............. number	24,979		29,254
Persons subsisted............ ——	124,895		146,273
Annual wages .... dollars	7,493,700		8,776,420
Paid for food furnished by farmers —	3,415,850		4,000,490

The following statement may be useful in making comparisons, and is therefore added:

The importation of manufactures of iron and steel in 1830, were:—

Side-arms and fire-arms, other than muskets and rifles	Drs.	179,153
Drawing knives, axes, adzes, and socket chisels..............		29,007
Bridle bits of every description		62,271

Steelyards, scale beams, and vices		Drs. 30,899
Cutting knives, sickles, scythes, reaping hooks, spades, and shovels		95,004
Screws, weighing 24 lbs. or upwards		17
Wood screws		66,817
Other articles not specified		2,908,978
Muskets	No. 8341	25,142
Rifles	8	85
Iron and steel wire	lbs. 592,733	59,485
Tacks, brads, and sprigs		2,799
Nails	613,704	40,906
Spikes	37,873	1,391
Cables and chains, and parts thereof	540,628	25,885
Mill cranks and mill iron, wrought............	2,781	200
Mill saws................................	4,395	12,252
Anchors	22,672	1,121
Anvils	677,246	31,249
Hammers and sledges	75,616	3,096
Castings	1,157,256	38,686
Braziers' rods	218,428	5,945
Nails and spike rods	32,848	784
Sheets and hoop	2,326,796	59,822
Slit or rolled for band, scroll or casement rods ..	2,845	81
In pigs..................................	cwt. 22,499	25,644
Bar and bolt, rolled......................	138,981	226,336
Hammered	lbs. 68,753,943	1,730,375
Steel..................................	cwt. 24,472	291,957

Nearly all the iron, with its manufactures imported, was received from England, except the hammered bar and bolt iron, of which 21,912,702 lbs. were from Russia, 45,206,082 lbs. from Norway and Sweden, 984,399 lbs. from England, leaving less than a million of pounds for all other places.

GENERAL.

PRICES OF IRON.

(*T. Tooke's High and Low Prices*, 1824.—*Iron*.)

The first considerable rise in foreign iron did not occur till 1796, when it advanced suddenly about 30 per cent. This was the year before the bank restriction, and the rise occurred in consequence of the importation having fallen off, instead of keeping pace with the increasing demand for consumption in this country, and in the rest of Europe, as well as in the United States of America; and the produce of our mines was at that time comparatively insignificant. Between 1796 and the close of 1800 there was no further advance. But the embargo in Russia in the latter year had the effect of raising the price 10 per cent. more, and an additional duty of about 1*l.* per ton had been laid on the importation, in the interval between 1796 and 1798. The advance altogether, therefore, including the new duty, was nearly 10*l.* per ton since 1795; and this great advance operated as a sufficient premium for applying increased capital to the production of iron in this country, and for bringing into operation for that purpose, all the powers of machinery, which was then undergoing a rapid improvement. Thenceforward the produce of iron in this country proceeded so rapidly, that, with the aid of further duties, amounting almost to a prohibition of importation, it not only kept pace with the increasing demand, but has eventually nearly superseded the use of foreign iron in this country, and has furnished a surplus for exportation. The price of foreign iron, accordingly, fell almost progressively from 1801 till the close of the war.

English iron advanced a little between 1800 and 1803, as a natural and inevitable consequence of the high price of foreign iron, which had been further raised by additional duties on importation; the quality, moreover, had been improved, and it was therefore really worth more, relatively to foreign iron, than it had before been. From 1803 till the close of the war, and further till 1817, being a period of fourteen years, the price maintained a singular degree of uniformity. In 1816 and 1817 a considerable demand for iron from this country to France took place, and continued through 1818 and 1819, on a very extensive scale, which had the effect of raising

the price of British iron higher than it had been during any period of the war. But, in 1820, such restrictions were laid on the import into that country, as to preclude any further shipments. In the meantime the continued improvements and increased power of machinery having been brought into extended operation, so as to augment the produce while the demand for export to France has fallen off, the subsequent decline is sufficiently accounted for.

	English in Pigs.	Russian Bars.		Swedish in Bars.	
	No Duty. Ton.	Ton.	Duty. Ton.	Ton.	Duty. Ton.
Years.	£ £	£	£ s. d.	£.	£ s. d.
1782	6 to 7½	11¾	2 16 2	15¾	2 16 2
		15¾	....	17¼	....
1783	6 — 7½	15¾	....	17¼	....
	4 — 6½	10¾	....	15¼	....
1784	4½ — 6½	10¾	....	14¾	....
	3 — 4	15½	....	17½	....
1785	3 — 5	12¾	....	14¾	....
	5 — 6½	14¾	....	15	....
1786	5 — 6½	14	....	14¼	....
	3 — 5	14¼ to 14¾	....	14¾	....
1787	3 — 5	14¾	....	15¾	....
	4½ — 6	15¼	....	15¼	....
1788	3 — 5	15	....	15¼	....
	3 — 7	13¾	....	16	....
1789	3 — 7	13¾	....	15¼	....
	4 — 7	14¼	....	16¼	....
1790	3 — 7	13	....	15	....
	5½ — 7½	15	....	17	....
1791	5½ — 7½	14¾	....	15¾	....
	5 — 7¼	14½	....	15½	....
1792	5 — 7½	14¾	....	16½	....
		15½ to 14½	....	17¼	....
1793	5 — 7½	14	....	16¾	....
		15 — 15½	....	17¼ to 18¼	....
1794	5 — 8	12½	....	16	....
		15½ — 12	....	17	....
1795	5 — 8	13 — 15½	....	15¼ to 16	....
		16 — 17		16¼ — 18	
1796	5 — 8	16¼ — 17¼	3 1 $9\frac{5}{20}$	17¼ — 19¼	3 1 $9\frac{5}{20}$
		21¼ — 22¼		21¾ — 22¾	
1797	5 — 8	20 — 21	3 4 $7\frac{2}{20}$	21 — 21½	3 4 $7\frac{2}{20}$
				22 — 23	
		21 — 20½		20 — 21½	
1798	5 — 8	20¼ — 21½	3 15 $5\frac{2}{20}$	22 — 23	3 15 $5\frac{2}{20}$
		19¾ — 20¼	....	21 — 22	....
1799	5 — 8	20 — 21½	....	22 — 23	....
1800	5 — 8	17 — 21	....	21½ — 23	....
	5½ — 9	21½ — 23½	....	22½ — 24	....
1801	5½ — 9	22½ — 23½	....	22½ — 23½	....
		23½ — 26½	....	25½ — 26½	....
		18 — 22½	....	20½ — 22½	....

	English in Pigs.	Russian Bars.		Swedish in Bars.	
	No Duty. Ton.	Ton.	Duty. Ton.	Ton.	Duty. Ton.
Years.	£ £	£ £	£ s. d.	£ £	£ s. d.
1802	5½ — 9	18¼ — 22½	....	20½ — 22½	....
		15¾ — 20¼	....	19½ — 20½	....
1803	5½ — 9	16 — 20	4 4 4½	19 — 20	4 4 4½
	7 — 9		....	21 — 22½	....
1804	7 — 9	16½ — 19½	4 17 1	20½ — 21½	4 17 1
		15 — 18½	....	20 — 21	....
1805	7 — 9	15 — 19	5 1 0	19 — 21	5 1 0
		15½ — 19½	....	19½ — 20½	....
1806	7 — 9	15½ — 19½	5 7 5¾	19½ — 20½	5 7 5¾
1807	7 — 9	15½ — 20½	....	19½ — 20½	....
		14½ — 19½	....		
1808	7 — 9	14½ — 19½	....	19½ — 20½	....
				17½ — 19½	
1809	7 — 9	14½ — 19½	5 9 10	17½ — 18½	5 9 10
			....	15½ — 17½	
1810	7 — 9	14½ — 19½	....	15½ — 17½	....
			....		
1811	7 — 9	14½ — 18½	....	15½ — 17½	....
1812	7 — 9	14½ — 18½	....	15½ — 17½	
		16½ — 19½	....		....
1813	7 — 9	16½ — 19½	6 9 10	15½ — 17½	6 9 10
		12½ — 16½	....	16½ — 17½	....
1814	7 — 9	12½ — 16½	....	16½ — 17½	....
				15½ — 16½	
1815	7 — 9	12½ — 16½	....	15½ — 16½	....
1816	7 — 9	12½ — 17½	....	15½ — 16½	....
		13½ — 16½			
		12½ — 15½			
1817	7 — 9	12½ — 15½	....	15½ — 16½	....
		16½ — 21½	....	None.	....
				15½ — 16½	
1818	7 — 9	16½ — 21½	....	15½ — 16½	....
	7½ — 9	15½ — 21½	....	18½ — 19½	....
	7 — 7½	18 — 21	....	16 — 17	....
	8 — 9	20 — 22	....	18 — 18½	....
1819	8½ — 9½	20 — 24	6 10 0	18 — 19	6 10 0
	8 — 9	17 — 21	....	16½ — 17½	....
1820	8½ — 9	17 — 21	....	16½ — 17½	....
	7½ — 8½	16½ — 20½	....	16 — 17	....
		14½ — 19½			
1821	6 — 7½	15 — 20	....	16 — 17	....
	6 — 7	14½ — 16½	....	15½ — 16	....
1822	6 — 6½	14½ — 16	....	15½ — 16½	....
	6 — 7	16½ — 18½	....	14 — 15	....

Note.—In 1826 the reduced duty on Foreign Iron (fixed at 30*s.* per ton), came into operation.

The price of Russian Iron, according to marks, generally varies from 14*l.* 10*s.* to 18*l.* 10*s.* per ton; of Swedish, common marks, 13*l.* to 13*l.* 10*s.* per ton; exclusive of duty.

NET PRICE OF SHROPSHIRE BAR-IRON IN BRISTOL.

	Per ton. £	s.	d.
1818.			
April.	11	0	0
July.	10	0	0
Oct.	10	10	0
1819.			
Jan.	11	10	0
April.	11	10	0
July.	10	10	0
Oct.	10	10	0
1820.			
Jan.	11	0	0
April.	9	10	0
July.	9	10	0
Oct.	9	10	0
1821.			
Jan.	8	10	0
April.	8	10	0
July.	8	10	0
Oct.	8	10	0
1822.			
Jan.	7	10	0
April.	7	10	0
July.	7	10	0
Oct.	8	10	0
1823.			
Jan.	7	10	0
Feb.	7	0	0
April.	7	10	0
July.	7	10	0
Oct.	7	10	0
1824.			
Jan.	8	0	0
April.	8	0	0
July.	9	0	0
Oct.	10	0	0
	11	0	0
Nov.	13	0	0
1825.			
Jan.	13	0	0
April.	14	0	0
May.	13	10	0
June	13	10	0
July.	11	10	0
Aug.	11	10	0
Oct.	10	0	0
Nov. / Dec.	10	0	0
1826.			
Jan.	10	0	0
April.	8	10	0
July.	7	10	0
Oct.	8	0	0
Dec.	8	10	0
1827.			
Jan.	8	10	0
April.	8	10	0
July	8	10	0
Oct.	8	10	0
1828.			
Jan.	8	0	0
April.	7	10	0
July.	7	0	0
Oct.	7	10	0
1829.			
Jan.	7	0	0
April.	6	15	0
May.	6	10	0
July.	6	10	0
Oct.	6	0	0
1830.			
Jan.	5	10	0
April.	5	10	0
July.	6	10	0
Oct.	5	10	0
1831.			
Jan.	5	10	0
April.	5	10	0
July.	5	10	0
Oct.	5	10	0
1832.			
Jan.	5	10	0
April.	5	10	0
July.	5	10	0
Oct.	5	10	0
1833.			
Jan.	6	0	0
April.	6	0	0
May.	6	10	0
July	6	10	0
Aug. / Sept.	6	15	0
Oct.	7	15	0
1834.			
Jan.	7	15	0
April.	7	15	0
July.	7	0	0
Oct.	7	0	0
1835.			
Jan.	7	0	0
April.	7	0	0
July.	7	0	0
Oct.	7	0	0
1836.			
Jan.	8	0	0
April.	10	15	0
July.	11	15	0
Oct.	11	15	0
1837.			
Jan.	10	15	0
April.	9	15	0
July.	7	15	0
Oct.	7	15	0
Nov.	9	0	0
Dec.	10	0	0
1838.			
Jan.	10	0	0
April.	10	0	0
July.	9	10	0
Oct.	9	10	0
1839.			
Jan.	9	10	0
Mar.	10	10	0
July.	10	10	0
Oct.	10	10	0
1840.			
Jan.	9	10	0
April.	9	5	0
July.	8	5	0
Oct.	9	5	0
1841.			
Jan.	9	5	0
April.	8	5	0

		Staffordshire Forge Pigs.								Staffordshire Merchant Bars.							
Date.	Qr.		£	s.	d.		£	s.	d.		£	s.	d.		£	s.	d.
1825.	July.	From	7	0	0	to	8	0	0	From	12	0	0	to	14	10	0
..	Oct.	..	7	10	0	..	7	0	0	..	12	0	0	..	12	5	0
1826.	Jan.	..	5	15	0	..	6	0	0	..	10	15	0	..	11	0	0
..	April.	..	5	0	0	..	5	5	0	..	9	15	0	..	10	0	0
..	July.	..	4	17	6	..	5	2	6	..	9	0	0	..	9	5	0
..	Oct.	..	4	12	6	..	4	15	0	..	8	5	0	..	8	10	0
1827.	Jan.	..	4	10	0	..	4	15	0	..	8	5	0	..	8	10	0
..	April.	..	3	17	6	..	4	2	6	..	7	10	0	..	7	15	0
..	July.	..	4	10	0	..	4	12	6	..	8	0	0	..	8	5	0
..	Oct.	..	4	5	0	..	4	10	0	..	8	0	0	..	8	5	0
1828.	Jan.	..	3	17	6	..	4	0	0	..	7	10	0	..	7	12	6
..	April.	..	3	15	0	..	3	15	0	..	7	10	0	..		..	
..	July.	..	3	15	0	..	3	15	0	..	6	15	0	..	7	0	0
..	Oct.	..	3	17	6	..	4	0	0	..	7	0	0	..	7	5	0
1829.	Jan.	..	3	15	0	..	3	17	6	..	6	15	0	..	7	0	0
..	April.	..	3	12	6	..	3	15	0	..	6	10	0	..	6	15	0
..	July.	..	3	12	6	..	3	15	0	..	6	10	0	..	6	15	0
..	Oct.	..	3	0	0	..	3	0	0	..	5	17	6	..	6	0	0
1830.	Jan.	..	3	0	0	..	3	5	0	..	5	10	0	..	6	0	0
..	April.	..	3	5	0	..	3	10	0	..	5	15	0	..	6	5	0
..	July.	..	3	15	0	..	3	15	0	..	6	15	0	..	7	0	0
..	Oct.	..	3	15	0	..	3	15	0	..	6	15	0	..	7	0	0
1831.	Jan.	..	3	0	0	..	3	0	0	..	5	17	6	..	6	0	0
..	Apr.	..	3	10	0	..	3	10	0	..	6	5	0	..	6	10	0
..	July.	..	2	17	6	..	3	2	6	..	5	10	0	..	6	0	0
..	Oct.	..	2	17	6	..	3	2	6	..	5	5	0	..	6	0	0
1832.	Jan.	..	3	0	0	..	3	5	0	..	5	10	0	..	6	0	0
..	April.	..	3	2	6	..	3	5	0	..	5	10	0	..	6	0	0
..	July.	..	3	0	0	..	3	5	0	..	5	15	0	..	6	0	0
..	Oct.	..	2	17	6	..	3	0	0	..	5	10	0	..	6	0	0
1833.	Jan.	..	3	0	0	..	3	2	6	..	5	10	0	..	6	0	0
..	April.	..	3	12	6	..	3	15	0	..	6	5	0	..	6	10	0
..	July.	..	3	15	0	..	3	17	6	..	6	10	0	..	6	15	0
..	Oct.	..	4	10	0	..	4	15	0	..	7	5	0	..	7	10	0
1834.	Jan.	..	4	12	6	..	4	15	0	..	7	15	0	..	8	0	0
..	April.	..	4	10	0	..	4	12	6	..	7	5	0	..	7	10	0
..	July.	..	4	0	0	..	4	5	0	..	6	15	0	..	7	0	0
..	Oct.	..	3	17	6	..	4	0	0	..	6	10	0	..	7	0	0
1835.	Jan.	..	3	17	6	..	4	0	0	..	6	10	0	..	6	15	0
..	April.	..	3	15	0	..	3	17	6	..	6	15	0	..	7	0	0
..	July.	..	3	12	6	..	3	15	0	..	6	10	0	..	7	0	0
..	Oct.	..	4	10	0	..	4	15	0	..	7	10	0	..	8	0	0
1836.	Jan.	..	5	15	0	..	6	0	0	..	9	15	0	..	10	0	0
..	April.	..	6	10	0	..	6	15	0	..	11	0	0	..	11	10	0
..	July.	..	6	10	0	..	6	15	0	..	11	0	0	..	11	10	0
..	Oct.	..	6	5	0	..	6	10	0	..	10	15	0	..	11	10	0
1837.	Jan.	..	6	0	0	..	6	7	6	..	10	10	0	..	11	0	0
..	April.	..	4	15	0	..	5	0	0	..	9	0	0	..	10	0	0
..	July.	..	3	10	0	..	3	15	0	..	6	15	0	..	7	0	0
..	Oct.	..	4	15	0	..	5	0	0	..	8	10	0	..	9	0	0
1838.	Jan.	..	4	17	6	..	5	2	6	..	9	0	0	..	9	5	0
..	April.	..	4	15	0	..	5	0	0	..	9	0	0	..	9	5	0
..	July.	..	4	15	0	..	5	0	0	..	9	0	0	..	9	5	0
..	Oct.	..	5	0	0	..	5	2	6	..	9	0	0	..	9	5	0
1839.	Jan.	..	5	0	0	..	5	10	0	..	9	10	0	..	10	0	0
..	April.	..	5	0	0	..	5	5	0	..	9	10	0	..	10	0	0
..	July.	..	5	0	0	..	5	5	0	..	9	10	0	..	10	0	0
..	Oct.	..	5	0	0	..	5	0	0	..	9	10	0	..	10	0	0
1840.	Jan.	..	4	10	0	..	4	15	0	..	8	10	0	..	9	0	0
..	April.	..	4	10	0	..	4	15	0	..	8	10	0	..	9	0	0
..	July.	..	4	0	0	..	4	5	0	..	7	15	0	..	8	0	0
..	Oct.	..	4	15	0	..	5	0	0	..	9	0	0	..	9	5	0
1841.	Jan.	..	4	10	0	..	4	15	0	..	8	5	0	..	9	0	0
..	April.	..	3	15	0	..	4	[illegible]	[illegible]	..	7	0	0	..	8	5	0

PRICES OF SOUTH WALES BAR IRON IN LONDON PER TON.

Years.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		Decemb.	
	£	s.	£	s.	£	s.	£	s.	£	s.	£	s.	£	s.	£	s.	£	s.	£	s.	£	s.	£	s.
1812	..		..		..		..		..		..		16	10	15	10	15	10	14	10	14	10	14	10
1813	14	10	14	10	14	10	14	0	14	0	14	0	13	10	13	10	13	10	13	10	13	10	13	0
1814	13	0	14	0	14	0	14	10	14	10	14	10	14	10	14	10	14	10	15	0	15	0	15	0
1815	15	0	15	0	15	0	15	0	14	10	14	10	13	10	13	10	13	10	13	10	13	10	13	10
1816	13	10	13	10	13	10	13	10	13	10	13	10	13	10	13	10	13	10	10	0	10	0	9	10
1817	9	0	9	0	9	0	9	0	9	10	9	10	11	0	12	0	13	5	13	5	14	10	14	10
1818	14	0	13	10	13	0	13	0	12	10	12	10	12	0	11	10	11	10	12	10	12	10	12	10
1819	12	10	13	0	13	0	13	0	13	0	13	0	13	0	12	10	12	10	12	10	12	10	12	10
1820	12	10	12	10	12	10	12	10	11	0	10	10	10	10	10	10	10	10	10	10	10	10	10	0
1821	9	10	9	10	9	10	10	0	10	0	10	0	9	10	9	10	9	0	9	0	8	15	8	15
1822	8	15	8	5	8	5	8	5	8	10	8	10	8	10	8	10	8	15	8	15	8	15	9	0
1823	8	10	8	10	8	10	8	10	8	10	8	10	8	10	8	10	8	10	8	10	8	10	8	10
1824	8	10	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	10	0	10	0	13	0
1825	13	10	13	10	15	10	15	10	15	10	15	10	14	10	11	0	11	0	11	0	11	0	11	0
1826	11	0	11	0	11	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10	10
1827	10	10	10	10	10	10	10	10	10	0	9	10	9	10	9	10	9	10	9	10	9	10	9	10
1828	9	5	9	5	9	5	9	0	8	15	8	15	8	5	8	5	8	5	8	5	8	5	8	5
1829	8	0	8	0	7	10	7	10	7	10	7	10	7	5	7	5	7	5	7	0	6	15	6	10
1830	6	10	6	10	6	10	6	10	6	15	7	0	7	0	7	0	7	0	6	15	6	10	6	5
1831	6	0	6	0	6	0	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5
1832	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	0	6	0	6	0	6	0	6	5
1833	6	10	6	10	6	15	6	15	6	15	7	5	7	5	7	5	7	5	7	10	8	0	8	0
1834	8	0	8	0	8	0	8	0	8	0	7	10	7	5	7	0	7	0	7	0	6	15	6	15
1835	6	15	6	15	6	15	6	15	6	15	6	15	6	15	6	5	6	15	7	15	8	0	8	0
1836	9	0	11	0	10	15	11	0	11	15	12	0	11	15	11	15	11	10	11	10	10	15	10	15
1837	10	15	10	10	10	10	10	0	9	15	9	0	8	5	7	10	9	0	10	0	10	0	9	10
1838	9	15	9	15	9	15	9	15	9	15	9	10	9	10	9	10	9	15	10	0	10	0	9	15
1839	10	10	10	10	10	10	10	10	10	0	10	0	10	5	10	5	10	5	10	5	10	5	9	15
1840	9	15	9	0	9	0	9	0	8	10	8	10	8	5	7	15	8	15	9	0	8	15	8	0

The London price is 20s. per ton above the prices at Cardiff and Newport, and 10s. per ton higher than Liverpool.

SOUTH WALES PRICES, FROM NEWPORT QUARTER-DAY BOOK.

		Bars.			Foundry Pigs.			Forge Pigs.		
		£	s.	d.	£	s.	d.	£	s.	d.
1803	Average price	15	0	0	6	10	0	5	10	0
1804	Do.	14	0	0	6	0	0	5	0	0
1805	Do.	16	0	0	6	10	0	6	0	0
1806	Do.	16	0	0	7	10	0	6	0	0
1807	Do.	13	0	0	6	6	8	5	0	0
1808	Do.	14	0	0	6	10	0	5	6	8
1809	Do.	14	0	0	6	10	0	5	6	8
1810	The prices open for every one to sell as he likes.									
1811	Average price	13	0	0						
1812	Do.	12	10	0	6	0	0	5	6	8
1813	Do.	12	10	0	6	0	0	5	6	8
1814	Do.	13	0	0	6	10	0			
1815	Do.	12	0	0						
1816	Do.	8	0	0						
1817	Do.	12	0	0	6	5	0			
1818	Do.	12	0	0	6	10	0			
1819	Do.	11	0	0	7	0	0			
1820	Do.	9	0	0	5	15	0	5	0	0
1821	Do.	8	0	0	5	0	0			
1822	Do.	8	0	0	5	15	0			
1823	Do.	7	10	0	5	0	0			
1824	The meetings at Newport given up.									

The following Papers, collected during the progress of this Work, are added with the view of assisting any statistical inquiry as to the consumption of Iron.

SHIPPING.

AN ACCOUNT OF THE NUMBER OF VESSELS, WITH THE AMOUNT OF THEIR TONNAGE, THAT WERE BUILT AND REGISTERED IN THE PORTS OF THE BRITISH EMPIRE, IN THE YEARS 1837, 1838, AND 1839.

	1837.		1838.		1839.	
	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.
United Kingdom	936	131,171	1,089	157,255	1,217	181,301
Isles of Guernsey, Jersey, and Man	69	4,751	58	4,204	61	5,602
British Plantations	510	71,306	606	79,947	368	47,898
Total.	1,515	207,228	1,753	241,406	1,646	234,801

SHIPPING—(*continued.*)

AN ACCOUNT OF THE NUMBER AND TONNAGE OF VESSELS, BELONGING TO THE BRITISH EMPIRE, ON THE 31st DECEMBER, OF EACH OF THE THREE YEARS, 1837, 1838, AND 1839.

	On 31 Dec. 1837.		On 31 Dec. 1838.		On 31 Dec. 1839.	
	Vessels.	Tons.	Vessels.	Tons.	Vessels.	Tons.
United Kingdom	19,936	2,296,227	20,300	2,383,484	21,037	2,531,005
Isles of Guernsey, Jersey, and Man	600	37,294	612	37,275	633	39,630
British Plantations ..	5,501	457,497	5,697	469,842	6,075	497,798
Total	26,037	2,791,018	26,609	2,890,601	27,745	3,068,433

G. R. Porter's "Parliamentary Tables of the Revenue, Commerce, &c. of the United Kingdom, and its Dependencies, 1839."

AN ACCOUNT OF THE NUMBER AND TONNAGE OF STEAM VESSELS BUILT AND REGISTERED IN THE BRITISH EMPIRE,

Distinguishing British Possessions in Europe from the British Plantations, in the year 1839.

	Vessels.		Tons.
England	43	....	2,885
Scotland......................	18	....	2,968
Ireland	1	....	286
Total (United Kingdom) ..	62	....	6,139
Isles of Guernsey, Jersey, and Man	..	....	..
British Plantations	3	....	383
Total	65	....	6,522

AN ACCOUNT OF THE NUMBER AND TONNAGE OF STEAM VESSELS BELONGING TO THE BRITISH EMPIRE,

Distinguishing British Possessions in Europe from the British Plantations, in the Year 1839.

	Vessels.		Tons.
England	517	....	45,160
Scotland	117	....	15,704
Ireland	86	....	18,376
Total (United Kingdom)..	720	....	79,240
Isles of Guernsey, Jersey, & Man	3	....	389
British Plantations............	47	....	7,132
Total	770	....	86,731

G. R. Porter's "Parliamentary Tables, &c. &c., 1839."

SHIPPING—(*continued.*)

MACHINERY EXPORTED, 1830—9.

AN ACCOUNT OF THE OFFICIAL VALUE OF MACHINERY EXPORTED,

Distinguishing the several heads of Steam Engines and parts of Steam Engines, Mill-work of all sorts allowed by Law to be Exported, Machinery of all other kinds allowed by Law to be Exported, and Machinery Exported under Licence from the Treasury or Privy Council, in each Year, from 1830 to 1839

	1830.	1831.	1832.	1833.	1834.
	£	£	£	£	£
Steam Engines and parts of Steam Engines	103,800	28,803	33,257	36,404	63,683
Mill-work, of all sorts allowed by law to be exported	40,434	18,229	13,093	18,735	15,563
Machinery, of all other kinds allowed by law to be exported	60,028	51,926	38,961	55,490	115,385
Machinery exported under licence from the Treasury or Privy Council	4,505	6,533	7,404	16,435	17,351
Total	208,767	105,491	92,715	127,064	211,982

	1835.	1836.	1837.	1838.	1839.
	£	£	£	£	£
Steam Engines and parts of Steam Engines	88,644	89,917	195,753	185,963	213,235
Mill-work, of all sorts allowed by law to be exported	21,565	29,707	39,304	41,095	25,955
Machinery, of all other kinds allowed by law to be exported	176,418	167,406	230,452	346,252	387,096
Machinery exported under licence from the Treasury or Privy Council	21,324	15,062	27,959	54,120	56,999
Total	307,951	302,092	493,468	627,430	683,285

G. R. Porter's "Parliamentary Tables, &c. &c., 1839."

STAFFORDSHIRE AND SHROPSHIRE IRON CARRIED ON THE GRAND JUNCTION CANAL TO LONDON IN THE YEARS 1814 TO 1840, INCLUSIVE.

TONS.

Years.	Manufactured Iron of all sorts.	Pigs.	Cast Iron Pipes.	Sundry Castings.	Wrought Iron Bedsteads	Total.
1814	19,452¾	2026	2221½	3330½	..	27,030¾
1815	14,900½	2832	2474¾	3239¾	..	23,447
1816	9,029	2397¾	1287¾	2626½	..	15,341
1817	15,809¾	2175¾	5354¾	4696½	..	28,036¾
1818	21,453½	2305¾	4996¼	5499	..	34,254½
1819	22,264½	2285¾	4229	7071	..	35,850¼
1820	17,722½	5207¾	445	8237	..	31,612¼
1821	17,269	3026½	1185¼	9349	..	30,829¾
1822	14,292¾	3129¼	2403¾	8825	..	28,650¾
1823	13,150¾	2023½	3725½	4708¼	..	23,608
1824	16,239¼	3587	2873½	4495¾	136½	27,332
1825	15,258	3470¾	905¼	9901¼	580½	30,115¾
1826	18,212	4688	..	11,790¼	576½	35,266¾
1827	17,675¾	2408¾	..	13,523¼	82	33,689¾
1828	16,041	1049½	..	8426¾	..	25,517¼
1829	17,382	1407¾	..	7260¼	257½	26,307½
1830	17,338½	1288¾	..	8204¾	57¾	26,889¾
1831	22,117¼	526½	21½	8572¾	32¾	31,270¾
1832	22,040¼	809¾	..	9606¼	4	32,460¼
1833	25,194½	428	..	8327½	68	34,018
1834	26,864	181½	..	10,900¼	56½	38,002¼
1835	25,427¼	419¾	..	13,542¼	4	39,393¼
1836	21,995¼	2089½	..	10,094¼	18	34,197
1837	27,256	3558	..	16,351	300	47,465
1838	33,055	3107	..	12,959	170	49,291
1839	35,855½	1547¾	..	11,142½	133	48,678¾
1840	43,613	1254	..	10,736	91	55,694

IRON CONVEYED ON THE ELLESMERE AND CHESTER CANAL.

Iron conveyed to Liverpool in the year 1838 :—

From Staffordshire	. .	38,758 tons.
North Wales	. .	11,687 „
Shropshire	. . .	9,961 „
Total	.	60,406

of which the Staffordshire may be considered manufactured iron; and also about 7000 tons from North Wales.

By the Middlewich branch of the Ellesmere Canal there went 10,370 tons, principally from North Wales, to Manchester.

The returns from Preston Brook were not obtained. A small quantity also went by the Macclesfield Canal to Manchester.

IRON WORKS IN THE WEST RIDING, YORKSHIRE—APRIL, 1840.

LOW MOOR.—8 blast furnaces, average about 50 tons each per week. Average about 150 tons of finished iron, boiler, plate, and merchant bars. Likewise manufacture locomotive engines; also cast cannon, bomb-shells, and shot. (14 puddling furnaces.)

BIERLY.—4 furnaces, average about 60 tons per furnace.

BOWLING.—4 furnaces, average about 60 tons per furnace; 11 puddling furnaces, finish about 100 tons of boiler plate and bar-iron; also manufacture steam-engines.

BIRKSTALL ABBEY.—No blast furnaces, 2 puddling furnaces, 4 scrap furnaces, finish about 40 tons of small merchant iron per week; 2 drawing-out hammers, get up axles for railway carriages, ships' knees, patent arms, &c.; also uses of different kinds. This work was erected in 1740.

LEEDS.—1 furnace, about 60 tons per week; 5 puddling and 1 scrap furnace, finish about 60 tons of bar-iron per week; 1 drawing-out hammer. Purchase part of their pigs.

WATERLOO.—1 charcoal blast furnace, about 40 tons per week; 1 charcoal fire; 1 puddling furnace.

HUNSLET.—No blast furnace; 1 puddling, and 1 scrap furnace; drawing-out hammer for country use, about 15 tons per week.

PARK GATE.—1 blast furnace, about 60 tons per week; 11 puddling furnaces, finish about 100 tons per week of boiler plate, sheet iron, merchant iron, &c. Get the principal part of their pig-iron from Derbyshire.

MILTON.—2 blast furnaces, about 70 tons each; 7 puddling furnaces; 2 drawing-out hammers, finish about 70 tons per week, boiler plate, merchant iron, &c.; also get up many cast iron bridges.

ELSICAR.—3 blast furnaces, about 60 tons each. Sell the pig-iron.

CHAPLETOWN.—2 blast furnaces, about 50 tons each; cast pipes and retorts.

THORNCLIFFE.—3 blast furnaces, about 50 tons each.

HOLMES.—2 blast furnaces, about 60 tons each.

SHEFFIELD PARK.—2 blast furnaces, about 50 tons each. Make sundry castings.

THORNHILL LEES.—No blast furnace; 2 puddling furnaces, wrought into boiler plate, and use iron, from 10 to 15 tons per week.

Gate Head Wire Mill.—1 charcoal fire, melting scraps, about 4 tons per week. Purchase blooms from north of Lancashire; manufactured into card wire, about 150 bundles per week.

IRON WORKS IN DERBYSHIRE—May 1840.

Derby (Suburbs of.)—No blast furnace; 5 puddling furnaces, finish about 50 tons per week of sheet and merchant iron.

Butterly. —2 blast furnaces, about 50 tons each.
Codnor Park. —3 ditto, about 60 tons each, same proprietors; 20 puddling furnaces, finish about 200 tons per week, boiler plate, sheet and merchant iron, and rails; also different castings, and steam-engines.

Lilleyshaw.—2 blast furnaces, about 55 tons each. Send their pigs into Yorkshire.

Duckmanton.—2 blast furnaces, about 50 tons each. Sell the pigs.

Stavely.—2 blast furnaces, about 50 tons each.

Morley Park.—2 blast furnaces, about 55 tons each, worked up at Atherslee; where are 4 puddling furnaces; 2 charcoal fires, finish about 60 to 70 tons per week of sheet, rod, and merchant iron.

IRON WORKS IN NORTHUMBERLAND—1839.*

Works in operation :—

The Birtley, about	90	tons per week	of pig-iron.
Wylam,	50	,,	,,
Lemington,	40	,,	,,
Ridsdale	40	,,	,,
	220	tons per week, or about 11,440 tons per annum.	

* IRON WORKS IN NORTHUMBERLAND—1841.

Birtley Iron Company	3	furnaces,	2	in blast.
Lemington do.	2	do.	1	do.
Benjamin Thompson	1	do.	1	do.
Hareshaw Iron Company	1	do.	1	do.
Ridsdale Iron Company	4	do.	1	do.

ROLLING MILLS.

Birtley roll about	30	tons per week.
Lemington	15	do.
Ridsdale Iron Company	150	do.
Hawks, Stanley and Company	150	do.
Losh, Wilson and Bell......	200	do.

GOVERNMENT RETURN OF HORSES AND CARRIAGES.

(From the Office of Stamps and Taxes—1839.)

HUSBANDRY HORSES.—None are now returned; but up to the end of 1838 they were returned, partly from some districts and not others.

Total exemptions for 1838:—Horses* . .		535,485
Of which husbandry horses .	382,920	
add ⅕ for supposed short returns	76,584	76,584
	459,504	
Also included in 535,485 as exempt, stage-coach and hackney-carriage horses	15,626	
Mileage duty paid on upwards of 4000 stage-carriages, number of miles averaged per day 126,000.		
The above number of horses may be doubled	15,626	15,626
	31,252	
1700 hackney-coaches in London, employing about 5000 horses . . .		5,000
		632,695
Horses charged with duty—1838 . .		309,364
		942,059
Allow for short returns		57,941
Total horses .		1,000,000

* Average of exemptions for horses in the preceding 5 years 588,988
Of which husbandry horses.......... 407,074

Carriages.†—Four wheels.—Total number charged ..	58,812	
Ditto exempted	3,642	
		62,454
Two wheels.—Total number charged	45,248	
Ditto exempted	22,472	
		67,720
		130,174

† Does not include waggons or carts, nor stage or hackney-carriages, which cannot be far short of 10,000 ($\frac{6}{10}$th 4 wheels) about 6000 being licensed by Board of Stamps and Taxes, of stages in Great Britain; and hackney-carriages in London only. The hackney-carriages in other large towns being licensed by the Excise Board under the post-horse duty act, there being always many spare carriages.

WASTE OF IRON IN FARMING.*

Arable land in England, 11,500,000 acres.
Annual waste of iron on a farm, taking 100 acres as an average.
Starting a farm of 100 acres.

Required 2 carts, broad wheels.
1 do. narrow wheels.
2 ploughs.
4 horses.

WHEELS.— 6 cwt. iron per cart, broad wheels.

12 cwt. 2 carts.
4 cwt. iron per cart, narrow wheels.

16
7 cwt. lost for ever.

9 cwt. change every 8 years.
4½ cwt. old iron.

4½ cwt. waste in 8 years, or per year 60 lbs.

HORSE SHOES.—Large shoes 10 lbs. per set, small shoes 6 lbs.= 8 lbs. per set.
Shoes 8 lbs. 4 sets per year, 32 lbs. per horse.

CHAINS.—1 set 16 lbs. will last 4 years, 4 lbs. per horse.

Waste per annum, after allowing for old iron:—

4 horses at 32 lbs. per horse . .	128 lbs. shoes.
at 4 lbs. ,, ...	16 ,, chains.
3 carts at 20 lbs. per cart . . .	60 ,,
2 ploughs at 20 lbs. per plough . .	40 ,,
	244 lbs. per annum

Loss of iron in every 100 acres, arable land, or about 12,500 tons on 11,500,000 acres.

4 horses per 100 acres = 460,000 horses,
3 carts ,, = 335,000 carts,
2 ploughs ,, = 230,000 ploughs,

besides harrows, scythes, sickles, forks, spades, and shovels.

* Brewster's Edinburgh Encyclopædia, vol. 8. p. 734.

BRITISH IRON AND IRON WARES EXPORTED FROM GREAT BRITAIN FROM 1796 TO 1814 INCLUSIVE.

	Bar Iron.	Pig.	Cast Iron.	Nails.	Wrought Iron and Hardware. Quantity.	Wrought Iron and Hardware. Real Value.	Ordnance and Small Arms.*
Years.	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.	£ s. d.	£ s. d.
1796	407 16 1 15	1,756 9 0 0	1,709 16 2 1	1,727 4 1 24	18,983 4 2 22	2,292,657 5 5	243,848 9 6
1797	1,317 15 0 1	897 10 0 0	1,573 9 3 5	1,202 4 1 16	17,235 18 1 11	1,930,841 11 9	170,066 11 5
1798	1,888 16 2 23	500 0 0 0	2,154 13 1 7	1,602 6 1 19	17,599 13 0 21	2,061,748 18 9	211,837 9 3
1799	2,675 14 2 12	1,446 13 0 0	2,619 15 1 21	2,101 9 1 22	23,756 0 2 25	2,780,037 10 10	349,631 7 11
1800	2,844 12 2 8	1,610 7 0 0	2,789 19 1 21	1,862 12 3 11	22,848 0 2 2	3,070,797 14 7	316,825 9 6
1801	3,001 3 1 6	1,583 14 0 0	2,908 3 3 2	2,155 1 3 11	20,883 9 2 21	2,673,787 2 10	254,657 6 8
1802	5,459 1 3 13	1,815 7 0 0	3,496 13 0 10	1,726 9 0 18	24,008 11 1 16	3,307,166 5 5	263,524 15 6
1803	3,574 2 1 18	1,532 19 0 0	2,342 8 3 1	1,441 3 2 0	16,966 5 1 17	2,361,813 10 9	201,988 17 11
1804	6,064 18 1 24	2,237 11 3 11	2,000 2 2 8	965 10 3 18	21,757 19 2 14	2,992,056 1 0	242,121 13 5
1805	6,594 16 3 3	3,276 0 0 25	1,982 18 3 16	725 7 2 7	20,685 6 1 5	2,833,832 19 6	198,566 4 11

	Bar Iron.	Pig.	Cast Iron.	Wrought Iron, not otherwise described.	Hardware and Cutlery.†	Ordnance.
	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.
1806	8,123 11 3 4	2,549 2 1 4	2,736 16 1 5	11,434 11 2 26	4,629 17 2 27	2,080 10 2 24
1807	10,863 4 1 18	2,925 18 3 16	2,286 15 2 26	18,373 12 0 11	4,669 0 0 16	2,603 13 2 12
1808	16,195 17 2 17	3,388 13 0 12	2,329 4 2 17	15,788 7 3 27	2,672 17 2 25	1,329 4 1 21
1809	The documents of these years destroyed by fire.					
1810						
1811						
1812	23,810 2 3 2	4,066 6 1 6	3,690 19 2 12	18,911 1 3 0	5,854 11 1 20	1,458 16 1 13
1813	The documents of this year destroyed by fire.					
1814	22,635 14 3 13	3,354 14 0 13	5,716 9 0 26	18,450 2 0 1	6,162 5 3 22	699 17 0 9

* Quantity not given. † Value not given.

Parliamentary Papers from which this Table was arranged:—No. 119, 21 April, 1806. No. 146, 5 May, 1806. No. 265, 2 May, 1815.

BRITISH IRON.—COUNTRIES TO WHICH EXPORTED.

Years.	Foreign Countries in Europe.	Ireland.	United States and Foreign Settlements in America.	Africa.	British West Indies and Northern Colonies.	Possessions in East Indies.
	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.
1796	3,565 9	3,721 14	6,538 9	490 15	7,848 8	2,419 17
1797	1,909 8	2,689 2	5,246 12	957 13	8,884 11	2,469 14
1798	2,516 8	2,424 10	5,816 13	1,505 17	9,732 16	1,899 2
1799	4,297 1	4,019 6	6,695 16	1,703 18	12,742 5	3,141 6
1800	6,438 13	4,370 8	6,218 7	1,065 4	10,277 10	3,585 11
1801	3,924 16	5,253 19	5,852 7	1,346 6	11,174 3	2,980 2
1802	6,243 17	6,671 19	6,735 8	1,250 16	10,791 7	4,812 15
1803	4,092 19	5,709 15	5,524 19	811 15	6,481 11	3,236 11
1804	4,933 7	8,290 15	6,044 6	1,308 3	8,697 0	3,752 13
1805	3,676 9	10,111 5	7,037 14	982 18	8,354 12	3,101 11

Parliamentary Paper:—No. 146, 5 May, 1806.

BRITISH IRON EXPORTED FROM 1806 TO 1814 INCLUSIVE.

Countries to which exported.	1806.	1807.	1808.	1809 to 1811.	1812.	1813.	1814.
	T. c.	T. c.	T. c.	Official Documents destroyed by Fire.	T. c.	Official Documents destroyed by Fire.	T. c.
Russia	253 18	134 16	0 1		28 2		323 6
Sweden	3 14	1 9	57 11		115 9		40 16
Norway and Denmark	238 3	356 10	23 0		85 10		54 5
Poland	2 5	..	..		..		14 1
Prussia	78 6	2 9	2 11		14 12		191 14
Germany	200 9	..	0 1		..		710 13
Heligoland	..	..	29 6		1 12		4 4
Holland	17 18	9 11	0 6		0 15		1,049 2
Flanders	..	..	..		..		348 8
France	..	..	..		1 10		1,913 4
Portugal and Madeira	2,284 17	2,719 16	1,364 17		4,685 13		2,984 17
Spain and Canaries	174 2	145 10	1,270 14		1,199 2		2,901 15
Gibraltar	145 1	388 12	1,281 0		1,346 19		1,130 0
Italy, Sicily, &c.	36 0	86 7	304 7		1,256 19		2,814 1
Malta	180 5	150 16	1,693 1		2,122 2		1,324 6
Turkey and Levant	15 14	0 10	..		27 7		99 19
Ireland	10,219 14	13,238 15	14,357 17		21,101 16		14,564 17
Isles—Guernsey, Jersey, &c.	334 17	424 9	530 10		597 2		398 0
United States of America	6,700 15	8,229 2	2,154 5		5,339 1		..
British Provinces in N. America	1,385 0	1,637 4	1,801 10		2,980 11		4,270 5
British West Indies, including conquered Colonies	10,735 3	7,667 5	6,477 14		5,921 12		8,140 13
Brazils	..	35 5	4,130 18		1,151 14		1,750 0
Foreign Colonies in America and the West Indies	1,473 15	751 0	429 19		447 8		1,477 10
Honduras Bay	36 16	77 4	94 9		33 0		27 17
Asia	4,918 16	4,586 4	4,415 4		8,601 6		9,133 8
Africa	1,918 19	1,079 11	1,285 3		732 15		1,352 2
Totals	41,354 7	41,722 5	41,704 4		57,791 17		57,019 3

Parliamentary Paper:—No. 265, 2 May, 1815.

FOREIGN IRON IMPORTED FROM 1800 to 1814 INCLUSIVE.

Years.	Bar.	Cast, old, Broken, &c.	Drawn or hammered.	Pig.	Hoops.	Wrought Nails, &c.
	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.
1800	38,154 18 3 11	716 19 3 5	1 13 0 16	184 18 2 2	1 15 0 0	26 0 2 18
1801	33,145 15 2 3	1332 2 1 10	6 19 2 25	370 2 1 23	5 6 1 21	52 8 0 23
1802	52,873 1 3 9	4766 0 1 27	5 17 2 14	682 5 3 2	.. ..	61 1 1 23
1803	43,442 17 0 19	1176 9 3 4	2 4 0 4	768 13 1 25	3 12 2 5	29 13 1 25
1804	22,300 3 2 16	436 8 3 1	28 6 1 1	463 1 3 17	.. ..	13 6 0 6
1805	27,157 16 2 12	547 1 2 23	16 2 1 3	368 8 3 24	1 3 1 26	15 16 2 3
1806	32,127 18 2 9	830 6 2 15	*	*	*	*
1807	23,731 0 2 19	263 10 3 3	*	*	*	*
1808	21,000 4 3 7	88 5 0 15	*	*	*	*
1809	24,479 10 2 13	*	*	*	*	*
1810	20,183 17 0 21	*	*	*	*	*
1811	27,956 0 0 1	*	*	*	*	(declared value)
1812	17,428 17 1 15	130 11 0 0	26 17 0 5	7 12 3 5	.. ..	£1425 3 1
1813	*	*	*	*	*	*
1814	21,909 0 2 24	687 19 3 6	33 9 3 14	13 2 0 20	1 19 2 22	410 15 3

FOREIGN IRON EXPORTED FROM 1800 TO 1814 INCLUSIVE.

1800	4993 3 0 17	.. ..	36 3 2 24	.. ..	.. ..	34 7 1 16
1801	4029 13 1 8	0 5 1 2	20 10 1 14	.. ..	.. ..	64 19 2 22
1802	6691 18 2 2	.. ..	39 5 2 8	16 0 0 0	9 15 2 17	12 19 3 12
1803	3609 2 3 24	.. ..	2 5 1 27	10 0 0 0	24 0 2 4	52 9 1 0
1804	3618 4 1 26	1 8 1 5	33 7 1 13	.. ..	.. ..	13 15 3 1
1805	4207 16 0 2	.. ..	5 2 2 6	.. ..	.. ..	13 10 1 8
1806	4716 18 3 0	.. ..	*	*	.. ..	*
1807	6537 5 2 6	.. ..	*	*	.. ..	*
1808	6621 18 2 21	.. ..	*	*	.. ..	(declared value)
1809	8602 10 2 4	.. ..	57 15 0 2	8 12 3 4	44 18 1 17	£2403 16 6
1810	11,367 16 2 9	.. ..	44 18 3 19	.. ..	11 5 1 0	1802 16 0
1811	8103 17 1 11	.. ..	62 5 0 27	.. ..	13 1 1 22	862 18 6
1812	9958 16 2 3	.. ..	36 17 3 19	.. ..	11 1 2 20	599 7 4
1813	*	*	*	*	*	*
1814	10,274 19 2 0	.. ..	3 1 2 21	.. ..	3 0 2 11	322 14 8

Nearly the whole of these Exports of Foreign Iron are to Ireland and Asia.
Parliamentary papers No. 76, 31st March, 1806—263-4, 2d May, 1815.

FOREIGN IRON—COUNTRIES FROM WHICH IMPORTED.

	Russia.	Sweden.	Norway and Denmark.	Other Countries.	Prize Iron.	Total.
Yrs.	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.	T. c. q. lb.
1805	10,108 2 0 15	16,976 6 2 17	298 0 1 24	313 16 1 13	96 7 0 23	27,792 12 3 8
1806	20,410 2 2 2	11,966 1 3 12	69 3 1 10	360 10 1 5	152 7 0 23	32,958 5 0 24
1807	10,460 19 1 7	13,133 10 1 20	117 11 0 24	115 17 0 9	166 13 1 18	23,994 11 1 22
1808	3402 16 1 5	16,500 4 1 6	.. ..	153 5 3 12	1032 3 1 27	21,088 9 3 22
1809	7158 15 3 1	16,542 16 0 4	127 0 1 10	85 6 2 21	565 11 3 5	24,479 10 2 13
1810	7376 19 2 11	12,051 15 3 13	201 18 0 23	111 5 2 20	441 17 3 10	20,183 17 0 21
1811	8518 6 0 11	18,791 14 2 16	207 12 3 22	6 8 0 7	431 18 1 1	27,956 0 0 1
1812	9837 3 3 27	6854 5 0 19	605 12 0 20	83 0 0 3	213 16 3 12	17,593 18 0 25
1813	*	*	*	*	*	*
1814	9853 18 0 7	12,156 10 0 1	138 18 1 4	448 8 0 0	47 17 3 18	22,645 12 1 2

1800 to 1804 countries not specified.

The columns marked * cannot be filled up in consequence of the destruction of the official documents by fire.

Parliamentary paper—No. 263, 2d May, 1815.

BRITISH IRON, &c. EXPORTED FROM 1815 TO 1839.

	Bar Iron.		Bolt and Rod Iron.		Pig Iron.		Cast Iron.		Iron Wire.		Wrought Iron, viz. Anchors, Grapnels, &c.		Wrought Iron, viz. Hoops.		Wrought Iron, viz. Nails.		Wrought Iron, viz. Of all other sorts except ordnance.		Iron, old, for remanufacture.		Unwrought Steel.		British hardwares and cutlery. Quantity.	British hardwares and cutlery. Declared value.
Years.	T.	c.	T.	c.	T.	c.	T.	c.	T.	c.	T.	c.	T.	c.	T.	c.	T.	c.	T.	c	T.	c.	T.	£
1815	26,309	0	8971	13	2708	9	6208	2	380	10	1311	14	6173	19	3806	12	6884	15	87	13	1280	12	15,472	2,349,662
1816	26,284	13	7875	3	2977	19	7307	2	141	5	854	4	5415	6	4096	1	6261	16	1057	4	959	14	13,915	1,987,082
1817	43,382	18	6660	0	6773	11	7180	12	120	3	1013	3	5720	0	4128	10	6528	11	1331	6	532	19	8190	1,197,875
1818	51,507	6	7862	16	5419	7	7622	7	165	3	1159	1	7006	10	4495	1	8015	11	604	15	809	10	11,058	1,721,364
1819	36,032	9	6366	1	3541	3	8410	19	218	5	684	18	6198	2	3399	5	7166	3	568	4	662	14	8699	1,316,047
1820	46,469	4	7937	11	5630	19	6647	14	169	2	545	2	7552	9	2846	15	6063	15	768	14	438	14	6697	949,086
1821	50,123	17	8484	5	7386	5	6555	12	248	7	560	13	7898	15	3288	17	6805	17	599	9	694	19	9037	1,237,692
1822	44,617	6	10,665	6	8259	1	6698	15	357	16	579	3	8947	12	3353	17	8104	19	920	12	784	16	10,467	1,334,895
1823	45,699	11	10,596	2	11,304	11	7269	14	288	10	1148	13	7772	10	3785	2	8686	15	18	13	654	1	10,376	1,264,444
1824*	38,387	15	7745	10	5370	13	9150	0	355	13	1459	11	7102	16	3980	11	8884	8	43	17	734	4	12,286	1,454,296
1825	25,613	19	4835	3	2815	16	5944	13	203	1	1395	12	5656	1	3555	5	8222	13	71	19	533	17	10,980	1,391,113
1826	33,253	0	7163	16	6563	6	5940	8	189	3	1679	14	7956	9	3538	2	9567	16	34	12	472	11	9627	1,169,105
1827	45,284	7	7337	7	7095	13	6292	0	207	10	1416	9	8505	13	3957	11	11,620	13	30	4	535	9	12,444	1,392,880
1828	51,108	10	7449	10	7826	19	6205	10	310	11	1230	1	8807	19	4596	8	11,703	6	108	10	917	7	12,100	1,385,617
1829	56,178	9	6475	13	8931	16	8219	16	329	3	1253	13	9532	9	4528	4	11,673	2	226	1	714	17	13,029	1,389,516
1830	59,795	4	8042	16	12,036	18	8854	14	365	11	1246	12	8057	0	4118	18	12,813	5	884	18	832	12	13,369	1,410,936
1831	64,012	12	6191	11	12,444	4	10,361	11	538	19	1004	18	8229	8	4361	12	14,013	6	1413	10	1207	3	16,799	1,620,632
1832	74,024	5	6938	2	17,566	1	12,495	1	666	7	1606	19	9417	14	4347	18	18,595	1	773	6	1112	0	15,295	1,433,298
1833	75,333	19	7311	2	22,988	15	14,763	18	517	19	2244	2	10,923	4	5069	9	21,378	9	696	0	1587	9	16,498	1,466,362
1834	70,809	2	9154	3	21,788	1	13,870	3	398	0	1941	16	12,046	7	5005	1	20,947	1	497	2	1709	2	16,276	1,485,233
1835	94,383	16	13,331	12	33,073	2	12,604	7	541	0	2347	0	13,957	1	5180	0	20,182	19	595	11	2810	3	20,197	1,833,043
1836	88,536	17	9225	18	33,880	6	19,891	9	643	11	2222	4	8992	5	5580	5	19,939	15	429	16	3014	11	21,072	2,271,313
1837	86,729	4	8934	0	44,387	18	12,373	11	453	5	2461	8	10,074	16	5249	15	19,414	12	1780	6	2432	17	13,372	1,460,807
1838	128,715	12	13,207	11	48,554	1	14,942	1	545	14	2849	19	12,482	12	6696	6	24,381	2	695	14	2946	9	15,295	1,498,327
1839	124,137	8	12,315	1	43,460	2	10,836	9	776	19	3107	9	11,225	8	7195	8	30,334	0	549	8	3974	2	21,177	1,828,521

* There are no returns of iron to Ireland after this date.

Parliamentary Papers from which this Table was arranged: No. 279, 5th May, 1819—376, 3d April, 1821—191, 30th March, 1825—313, 5th June, 1829—45, 2d Dec. 1830—455, 18th May, 1832—297, 17th May, 1833—299, 18th June, 1835—416, 17th July, 1839—104 and 105, 1840.

FOREIGN IRON IMPORTED FROM 1815 TO 1839.

	Iron in bars, or unwrought.	Iron, slit, or hammered into rods, or less than ¾ in. square.	Old broken and old cast iron.	Iron in Pigs.	Iron wire and hoops.	Unwrought Steel.
Years.	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.
1815	21,378 14	17 12	760 10	189 15	2 11	486 7
1816	8489 13	4 10	406 5	27 8	..	947 0
1817	10,138 15	..	123 7	..	..	1219 11
1818	16,603 7	..	152 13	1 10	..	1629 18
1819	13,968 13	17 19	236 7	1 0	..	
1820	*1014 11 9869 9	2 17	170 15	30 18	..	
1821	10,155 4 *371 1	4 9	224 5	23 2	4 9	no returns.
1822	12,768 19 *345 10	12 15 *3 6	156 19	1 5	4 8	
1823	13,456 15 *369 10	1 14	206 18	..	3 12	
1824	14,246 1 *351 1	4 7	511 0	0 10	6 9	
1825	23,181 16 *232 0	65 4	1273 17	1393 15	7 16	165 15
1826	12,952 19	0 16	520 11	149 8	5 14	207 14
1827	18,478 1	..	256 19	77 3	3 18	276 16
1828	15,050 13	1 3	230 8	164 3	1 15	375 9
1829	15,148 0	6 1	200 4	30 12	1 7	407 4
1830	14,947 4	..	207 4	6 3	1 19	945 17
1831	17,421 8	52 14	253 9	5 10	11 14	1313 6
1832	18,961 12	1 15	159 7	30 6	0 12	622 4
1833	17,913 5	3 15	125 12	41 0	1 2	834 16
1834	16,215 7	10 7	65 0	108 9	0 11	698 6
1835	19,750 8	3 1	60 18	60 14	3 17	969 6
1836	25,033 11	8 5	634 6	84 3	1 0	1064 11
1837	19,272 0	..	219 3	194 19	6 1	423 10
1838	23,007 2 †37 19	12 2	286 12	519 16	11 2	497 1
1839	20,826 9 †389 10	..	154 3	2241 18	0 3	650 16

* Foreign Iron imported into Ireland.

† Bloom Iron.

The Unwrought Steel is imported from Sweden, with the exception of a small quantity principally from Italy.

Parliamentary Papers, &c. from which this and the following table were arranged: Nos. 280, 5 May, 1819—281, 5 May, 1819—376, 3 April, 1821—191, 30 Mar. 1825—313, 5 June, 1829—45, 2 Dec. 1830—455, 18 May, 1832—297, 17 May, 1833—290, 18 June, 1835—416, 17 July, 1839—103, 1840.

…REIGN IRON EXPORTED FROM 1815 TO 1839.

…rs.	…n in bars, … unwrought.	Iron slit, or hammered into rods, or less than ¾ in. square.	Old broken and old cast iron.	Iron in Pigs.	Iron wire and hoops.	Un-wrought Steel
	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.
…815	14,018 0	13 9	..	..	2 11	307 2
…816	8623 16	1 17	..	..	..	805 2
1817	4057 3	..	..	..	..	1016 5
1818	4977 10	..	..	..	..	1053 10
1819	3909 3	..	..	..	..	no returns.
1820	3627 12	0 18	..	..	..	
1821	4002 10	21 7	..	..	..	
1822	3993 9	10 18	..	..	..	
1823	3332 11	1 17	..	..	..	
1824	4037 4	3 2	..	..	0 1	
1825	6705 18	2 9	..	..	..	210 19
1826	2261 19	45 1	..	28 2	..	153 18
1827	3453 13	..	..	130 0	..	397 4
1828	2991 5	15 6	..	10 9	..	235 1
1829	3024 7	..	2 5	12 9	0 10	587 9
1830	2968 10	5 8	0 3	44 9		625 6
1831	4254 14	6 10	..	..	10 17	1122 17
1832	3450 13	46 4	..	9 9	..	810 13
1833	2024 9	3 13	17 8	..	..	769 9
1834	2885 6	..	4 5	43 13	..	762 19
1835	2635 9	3 19	4 19	30 0	3 3	1361 4
1836	4761 17	3 14	..	..	0 8	965 5
1837	2617 13	..	..	14 4	0 11	341 7
1838	4368 10	..	3 18	70 0	11 19	648 0
1839	4484 10	..	..	3 14	..	699 6

IMPORTS INTO THE UNITED KINGDOM.

Iron and Steel.	Quantities Imported.		Quantities entered for Home consumption.		Gross amount of duty received.	
	Yrs.end.5Jan. 1840.	1841.	Yrs.end.5Jan. 1840.	1841.	Yrs.end.5Jan. 1840. £	1841. £
Iron, in bars or unwrought.... Tons	20,826	18,648	18,437	13,368	27,155	20,855
Steel, unwrought............ Cwt.	13,016	14,702	177	2	32	

EXPORTS OF FOREIGN IRON AND STEEL FROM THE UNITED KINGDOM.

	QUANTITIES EXPORTED. Year ending 5th January, 1840.	1841.
	T. c. q. lb.	T. c. q. lb.
Iron, in bars or unwrought....	4484 9 3 25	5661 6 0 17
	C. q. lb.	C. q. lb.
Steel, unwrought............	13,986 2 16	13,199 0 11

EXPORTS OF BRITISH IRON AND STEEL, AND HARDWARES AND CUTLERY, FROM THE UNITED KINGDOM.

	Declared value of the Exportations in the year ending 5th January, 1840.	1841.
Iron and Steel........	£2,719,825	2,508,526
Hardwares and Cutlery	1,828,521	1,345,881

Parliamentary Paper—No. 61, 19 Feb. 1841.

FOREIGN IRON IMPORTED FROM 1815 TO 1839, DISTINGUISHING THE COUNTRIES FROM WHICH THE SAME WAS IMPORTED.

From	1815.	1816.	1817.	1818.	1819.	1820.	1821.	1822.	1823.	1824.	1825.	1826.	1827.
	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.
Russia	6,147 14	2,645 13	1,710 7	4,450 15	4,750 6	3,354 2	3,071 8	3,022 4	5,763 18	4,660 11	8,806 10	5,131 7	8,472 0
Sweden	15,539 7	6,979 4	9,645 7	13,715 17	9,270 18	7,095 11	7,508 0	10,129 10	7,985 5	9,861 0	15,356 13	7,072 11	9,902 1
Norway	388 9	8 4	0 9	10 19	10 6	5 14	30 9	21 0	23 11	35 18	471 13	111 9	135 19
Denmark	..	30 14	29 15	10 6	157 15	..	18 17	4 6	12 4	37 4	32 13	73 8	9 9
Prussia & Germany	247 19	113 13	21 4	4 5	2 18	..	85 6	51 2	118 19	200 14	697 16	149 7	57 14
Belgium	..	..	..	..	..	..	..	0 6	2 0	64 13	299 16	2 0	33 1
France	32 9	..	..	..	..	..	..	..	..	70 18	24 12	0 8	281 7
Spain	..	..	..	0 1	0 5	..	..	..	..	..	15 11	0 16	10 0
Other Countries	479 9	97 8	74 10	195 5	30 18	33 3	68 9	61 7	132 13	135 11	551 11	395 16	191 6
Totals	22,835 7	9,874 10	11,481 12	18,387 8	14,223 6	11,088 10	10,782 9	13,280 15	14,038 10	15,084 9	26,346 15	13,837 2	19,002 17

From	1828.	1829.	1830.	1831.	1832.	1833.	1834.	1835.	1836.	1837.	1838.	1839.
	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.
Russia	5,131 16	5,705 13	5,122 14	5,271 2	6,624 19	4,870 2	2,688 0	5,462 14	7,579 14	7,123 1	6,533 18	3,358 3
Sweden	9,216 15	9,364 17	10,262 11	12,961 1	12,280 9	13,003 2	13,288 13	14,699 1	17,708 15	11,655 8	16,043 16	17,838 12
Norway	66 7	343 8	390 16	376 17	540 7	608 17	605 6	380 15	625 19	519 15	399 0	512 12
Denmark	13 13	1 0	31 5	21 16	5 11	31 14	45 10	5 11	61 7	6 19	6 1	4 2
Prussia & Germany	50 11	85 8	141 12	153 11	28 8	36 8	119 14	7 3	188 11	33 19	18 14	78 19
Belgium & Holland	28 2	30 9	27 7	125 8	1 2	..	0 11	..	..	..	4 15	72 19
France	378 8	8 6	..	78 14	140 10	151 8	0 12	32 0	15 19	27 14	10 12	8 11
Spain	6 17	135 11	35 8	..	47 9	117 2	177 2	17 5	149 3	74 7	123 2	33 1
Other Countries	929 5	118 8	96 12	20 4	106 3	94 8	156 3	252 15	496 8	*609 9	*1,230 17	2,453 2
Totals	15,821 14	15,793 0	16,108 5	19,008 13	19,775 17	18,013 1	17,081 11	20,857 4	20,825 16	20,110 12	24,370 15	24,360 1

* Principally from the East Indies.

Parliamentary Papers from which this Table was arranged:—No. 280, May 5, 1819. 281, May 5, 1819. 376, April 3, 1821. 191, March 30, 1825. 313, June 5, 1829. 45, Dec. 2, 1830. 455, May 18, 1832. 207, May 17, 1833. 299, June 18, 1835. 416, July 17, 1839—103, 1840.

1815 TO 1839, ORTED.

825.		1826.			1836.		1837.		1838.		1839.	
T.	c.	T.	c.	c.	T.	c.	T.	c.	T.	c.	T.	c.
152	14	158	13	6	3,136	13	944	12	934	10	952	2
211	9	10	11	12	89	11	117	15	149	16	238	3
44	6	94	[illegible]	5	176	5	277	3	320	15	307	12
313	9	319	1[illegible]	6	2,238	7	3,457	2	11,867	2	6,179	10
60	3	68	1[illegible]	5	822	19	1,894	10	2,047	17	3,384	6
803	19	2,615	[illegible]	1	6,097	9	11,607	15	16,818	10	12,850	9
..		..		16	10,026	10	18,900	1	26,837	18	24,226	1
,441	9	4,759	1[illegible]									
..		..		8	4,917	14	10,995	1	6,982	1	2,657	17
273	0	7,910	1[illegible]	14	14,422	4	15,521	19	16,231	3	14,934	1
,859	2	6,067	[illegible]	14	5,239	5	6,304	4	8,336	14	6,721	2
,749	16	1,493	[illegible]	17	1,578	9	1,524	5	1,572	16	1,244	2
,232	14	1,601		3	746	8	1,631	14	2,291	1	2,776	1
,805	0	9,435		17	10,878	7	12,460	13	21,004	6	19,125	2
503	12	660	1	12	290	3	386	15	1,156	5	830	3
29	1	99	1	1	150	18	343	18	524	8	206	4
,208	11	2,273	1	17	4,049	2	5,386	7	9,368	4	7,486	17
				16	37	18	473	8	581	0	1,100	3
..		..										
237	0	190	1									
601	17	1,093		6	1,063	9	1,155	6	1,306	7	1,518	0
,612	5	12,631	[illegible]	15	18,730	18	21,395	19	25,137	10	27,376	0
,456	5	1,411	[illegible]	1	3,603	7	3,237	13	4,402	15	4,867	19
,431	2	6,067	[illegible]	14	12,800	9	12,449	0	13,964	1	21,547	1
,534	0	6,908	[illegible]	9	8,194	2	8,088	11	7,251	10	6,626	0
,527	0	2,515		4	4,887	13	7,903	15	7,259	10	6,973	12
,037	4	12,491		16	91,387	14	54,120	2	78,039	17	85,171	11
,602	7	2,789		6	4,304	19	3,369	8	4,285	15	4,581	13
,101	4	2,317		10	3,558	6	3,716	8	2,640	9	5,206	13
,828	9	85,985		11	213,428	19	207,663	4	271,312	0	269,088	13

1821. *191, Ma* 18, 1835. 104 and 105, 1[illegible]

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